

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE		PAGE OF PAGES 1 9	
2. AMENDMENT/MODIFICATION NO. 0001		3. EFFECTIVE DATE 13-Nov-2011		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO.(If applicable) ANA 12-008	
6. ISSUED BY AFGHANISTAN DISTRICT SOUTH (AES) US ARMY CORPS OF ENGINEERS APO AE 09355		CODE W5J9LE		7. ADMINISTERED BY (If other than item 6) <div style="text-align: center;">See Item 6</div>			
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)				X		9A. AMENDMENT OF SOLICITATION NO. W5J9LE-12-B-0002	
				X		9B. DATED (SEE ITEM 11) 21-Oct-2011	
						10A. MOD. OF CONTRACT/ORDER NO.	
						10B. DATED (SEE ITEM 13)	
CODE		FACILITY CODE					
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS							
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> is not extended. Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning <u>1</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.							
12. ACCOUNTING AND APPROPRIATION DATA (If required)							
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.							
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.							
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).							
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:							
D. OTHER (Specify type of modification and authority)							
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.							
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) 1. Project: ANA 1/4/205th Deh Raw ood (Camp Hadrain) Uruzgan Province, Afghanistan. 2. The purpose of this amendment is to answer bidder inquiry questions. Sections 01010 and 01015 have been revised accordingly. Additional drawings are also provided. The bid due date remains 21 Nov 2011 at 2:00PM. 3. POC is Mark Jones at mark.t.jones@usace.army.mil.							
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.							
15A. NAME AND TITLE OF SIGNER (Type or print)				16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)			
				TEL: _____ EMAIL: _____			
15B. CONTRACTOR/OFFEROR		15C. DATE SIGNED		16B. UNITED STATES OF AMERICA		16C. DATE SIGNED	
_____ (Signature of person authorized to sign)				BY _____ (Signature of Contracting Officer)		13-Nov-2011	

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

SECTION 00800 - SPECIAL CONTRACT REQUIREMENTS

The following have been added by full text:

AMEND0001 Q&A

Bidder Inquiry Questions and Answers for W5J9LE-12-B-0002

1. Section 00100, "Bidding Schedule/Instructions to Bidders", section "Information to Bidders" provides the contents of the proposal as only Standard Form 1442 Back (signed), Bid Schedule, Section 00600, Representations and Certifications, and Offer guarantee. Is the DBA Form included in Section 00100, "Bidding Schedule/Instructions to Bidders", also required?

Answer: Yes. Please include with your bid package

2. Section 00100, "Bidding Schedule/Instructions to Bidders", section "Bid Submission" states "Envelope (s) shall be plainly marked with the following information:
Solicitation No. W5J9LE-12-B-0001 _____

Opening Date _____

Number of each amendment, which has been received"

However, SF-1442, Item 13A states "Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due."

Please clarify the information and format that is required to be included on the envelope.

Answer: Your envelope should contain the following into:

- Offeror's name and address
- Solicitation Number
- Opening date (which is the same as date and time offers are due
- Number of each amendment which has been received (optional)

3. Section 00555, "Design Concept Documents", Part 1.3, "Specifications" states "The Government will provide Division 1 specifications sections as required, to the successful Offeror; and these sections shall be included in the final construction specifications without change." USACE is requested to provide any additional specifications that will be required such that we can factor that into our proposal cost estimate.

Answer: All Division 1 Specifications are included in the solicitation

4. Section 01010, "Scope of Work", Part 3.14.1, "Dispensers and Fuel Tanks", states "The Contractor shall design and construct above-ground fuel tanks. Fuel Storage capacity shall be 50,000 liters of diesel fuel and 5,000 liters of MOGAS" which is to be included under CLIN 0002AP. Part 5.12, "Power Plant", states "The contractor shall design and construct fuel storage sized to store a 30 day supply" which is to be included under CLIN 0004AM. However, Section 01015, "Technical Requirements", Part 6.11.1, "Fuel Oil Storage and Containment", states "Fuel Oil Storage and Distribution system shall be

provided to support the operation of diesel engine generator set(s) and tank(s) and to support the vehicles used at various locations.” Are all fuel tanks to be located in the same location and, if so, under which CLIN should this cost be reflected?

Answer: **The storage tanks at the vehicle fuel point shall have the volumes specified in section 01010. The fuel storage tanks for the generators shall be sized to store 30 days’ supply of fuel. The contractor can co-locate the fuel storage at his discretion. The vehicle fuel storage and power plant fuel storage pricing shall be included in the appropriate CLINs.**

5. Section 01010, “Scope of Work”, Part 3.17.1, “Medical Waste Incinerator”, states “The incinerator shall meet the specifications here and in Section 1015.” Section 01015, “Technical Requirements”, does not appear to contain specifications relative to an incinerator. Please clarify.

Answer: **Please see revised language in paragraph 5.14, Section 01015 in the amendment.**

6. Section 01010, “Scope of Work”, Part 3.19, “Parade Field”, states “The Parade Field shall be 60m x 30m.” However the area shown on Drawing C-1, “Parade Ground Review Stand Site Plan” shows this area to be 80m X 60m and the Concept Plan scales to approximately 80m X 60m. What dimensions for the Parade Field should be used in our estimate?

Answer: **Please see revised Paragraph 3.19 in Section 01010**

7. Section 01010, “Scope of Work”, Part 4.1, “Perimeter Wall” states “The wall shall be topped with Y shaped outriggers and single-coil concertina style razor wire.” However, Section 01015, “Technical Requirements”, Part 2.3.1.1, “Perimeter Wall”, states “Outriggers shall be installed to support barbed wires and 2 strands of concertina style razor wire.” Please clarify if single-coil or 2 strands of concertina style razor wire is required atop the perimeter wall.

Answer: **Please see revised language in paragraph 2.3.1.1, Section 01015 in the amendment.**

8. Section 01010, “Scope of Work”, Part 5.3.2, “Footpaths/Firelanes”, states “the Contractor shall design and construct 1.5 m wide concrete foot paths.” However, Section 01015, “Technical Requirements”, Part 2.3, “Roads, Parking, Maneuver, and Storage Areas, and Foot Paths”, states “The Contractor shall provide a 100 mm thick by 3 m wide aggregate foot paths between buildings, parking areas, and other logically anticipated areas to serve as pedestrian foot paths and fire lanes.” Are the Footpaths to be aggregate or concrete?

Answer: **Please see revised paragraph 2.3, Section 1015 of the amendment.**

9. Section 01010, “Scope of Work”, Part 5.3.2, “Footpaths/Firelanes”, states “The Contractor shall design and construct firelanes on a minimum of three (3) sides of all buildings. Fire lanes shall be a minimum of three (3) meters wide and paved with a minimum of 150 mm of concrete paving.” However, Section 01015, “Technical Requirements”, Part 2.3, “Roads, Parking, Maneuver, and Storage Areas, and Foot Paths”, states “The Contractor shall provide a 100 mm thick by 3 m wide aggregate foot paths between buildings, parking areas, and other logically anticipated areas to serve as pedestrian foot paths and fire lanes.” Are the firelanes to be aggregate or concrete?

Answer: **Please see revised paragraph 2.3, Section 1015 of the amendment.**

10. Section 01010, “Scope of Work”, Part 5.3.3, “Parking” states “design and construct parking for individual facilities based on the Concept Plan and on the parking

requirements for each facility". The concept site plan only shows parking areas for 6 vehicles in proximity to the Clinic and 4 vehicles in proximity to the WWTP. Please provide the parking requirements for each facility.

Answer: **The parking shall be provided as shown on the Concept Plan.**

11. Section 01010, "Scope of Work", Part 5.5, "Well House and System", states "FENCES: Surrounding the well house shall be a 3 m high chain link security fences with Y-channel and triple strand concertina wire with one (1) lockable personnel gate for the backup generator building, one (1) lockable double swing arm gate and one (1) personnel gate for the well and pump house building. The fencing shall be offset 3m from the exterior walls of the buildings. Construct the fencing and gates per the Fencing Details provided in the Appendix." However, Part 5.6, "Booster Pump System", has very similar verbiage and the Concept Plan shows fencing around the entire Water Supply Compound including the Well House, Booster Pump Building and Water Storage Tank. Please clarify what area(s) are to be fenced and under what CLIN these costs should be included.

Answer: **Please see revised paragraph 5.5, Section 01010 of the amendment.**

12. Section 01010, "Scope of Work", Part 5.6, "Booster Pump System", states "FENCES: Surrounding the backup generator system and booster pump building(s) shall be a 3 m high chain link security fences with Y-channel and triple strand concertina wire with one (1) lockable personnel gate for the backup generator building, one (1) lockable double swing arm gate and one (1) personnel gate for the booster pump house building. The fencing shall be offset 3m from the exterior walls of the buildings. Construct the fencing and gates per the Fencing Details provided in the Appendix." However, Part 5.5, "Well House and System", has very similar verbiage and the Concept Plan shows fencing around the entire Water Supply Compound including the Well House, Booster Pump Building and Water Storage Tank. Please clarify what area(s) are to be fenced and under what CLIN these costs should be included.

Answer: **See answer to #11 above**

13. Section 01010, "Scope of Work", Part 5.10, "Wastewater Treatment Plant", states "The capacity of the wastewater treatment plant shall be 150,000 liters per day." However, Section 01015, "Technical Requirements", Part 2.4.4.2, "Requirements of Design", states "Wastewater Hydraulic Load: Individual wastewater generation rate of 930,000 liters per day. Design to pass 200% of design capacity without overflowing." Please clarify the design basis flow rate for the wastewater treatment plant.

Answer: **Please see revised paragraph 2.4.4.2, Section 01015 of the amendment.**

14. Section 01010, "Scope of Work", Part 5.12, "Power Plant", states "The contractor shall design and construct fuel storage sized to store a 30 day supply" which is to be included under CLIN 0004AM. Part 3.14.1, "Dispensers and Fuel Tanks", states "The Contractor shall design and construct above-ground fuel tanks. Fuel Storage capacity shall be 50,000 liters of diesel fuel and 5,000 liters of MOGAS" which is to be included under CLIN 0002AP. However, Section 01015, "Technical Requirements", Part 6.11.1, "Fuel Oil Storage and Containment", states "Fuel Oil Storage and Distribution system shall be provided to support the operation of diesel engine generator set(s) and tank(s) and to support the vehicles used at various locations." Are all fuel tanks to be located in the same location and, if so, under which CLIN should this cost be reflected?

Answer: **See #4 above.**

15. Section 01010, "Scope of Work", Part 5.14, "Site Communication System", states "The communications duct bank shall run to all buildings to include guard towers, guard

shacks, ECPs, and back to the Central Communications Room located in the Headquarters Building.” Is it required to run the communications duct bank to all buildings (including latrines, POL, etc.)?

Answer: **Please see revised language in paragraph 5.14, Section 01010 in the amendment.**

16. Section 01015, “Technical Requirements”, Part 2.2.2, “Demolition” states “There is currently a perimeter Hesco wall and fence that shall be removed. One guard tower shall be demolished.” Section 01010, “Scope of Work”, Part 5.1, “Demolition”, states “The Contractor shall demolish and remove the existing perimeter wall and conex containers at the site. The approximate locations of the existing perimeter wall and conex containers are shown on the Concept Plan in the Appendix.” Appendix B, “Site Assessment”, paragraph 3.3, “Existing Site Development”, states “The site presently contains a 2.4m high stone wall enclosing an area of 226 m by 253 m.” Please clarify what is on site that is to be demolished.

Answer: **It is the contractor’s responsibility to determine the location and quantity of all items to be demolished in order to complete the contract. The government encourages but does not require a site visit to aid the determination. Please see revised language in paragraph 2.2.2 in Section 01015 and paragraph 5.1 in Section 01010.**

17. Section 01015, “Technical Requirements”, Part 2.2.3, “Site Grading & Drainage”, states “The Contractor shall provide all necessary site grading to insure adequate drainage so that no areas will be flooded due to a rainfall of a 10-year frequency” and “Protection of facilities from flood waters originating offsite of an installation shall be based on a rainfall for a 25-year frequency event.” Please clarify if the design basis is to be a 10-year or 25-year frequency event.

Answer: **The contractor should use the AED Design Requirements for the design basis. Please see paragraph 2.2.3, Section 01015 in the amendment.**

18. Section 01015, “Technical Requirements”, Part 2.4.4.2, “Requirements of Design”, states “Wastewater Hydraulic Load: Individual wastewater generation rate of 930,000 liters per day. Design to pass 200% of design capacity without overflowing.” However, Section 01010, “Scope of Work”, Part 5.10, “Wastewater Treatment Plant”, states “The capacity of the wastewater treatment plant shall be 150,000 liters per day.” Please clarify the design basis flowrate for the wastewater treatment plant.

Answer: **Please see revised paragraph 2.4.4.2, Section 01015 in the amendment.**

19. Section 01015, “Technical Requirements”, Part 4.13.6.3, “Harden Interior Walls”, states “interior wall structure shall be CMU (min thickness = 100 mm). Interior walls shall be plaster applied in a similar manner as exterior stucco.” However, the drawings included in Appendix A have interior walls details that show metal studs with gypsum board. Please clarify.

Answer: **For all buildings where standard designs have been supplied by the government, the buildings shall be constructed per the standard design. For all buildings where the contractor is responsible for the design, the contractor shall design in accordance with section 01010 and Section 01015.**

20. Section 01335, "Submittal Procedures", Part 3.6, "Submittal Procedure" as written (including size, number of copies, etc.) implies use of paper submittals. Can electronic submittal and approvals be used for this Project?

Answer: This topic will be covered at the Preconstruction Conference

21. Appendix A, Drawing A-01, "Schedule of Drawings", indicates that the following drawings were to be included but are not included in the 30 PDF files:

- Non Arch-Span Facilities - Well House
- Non Arch-Span Facilities - Well House Section Piping
- Force Protection - ECP Canopy

Please provide.

Answer: **Please see revised Appendix in the amendment.**

22. Appendix A, package L-05 - Latrines - Small - Arch Span, Drawing G-002, "Index of Drawings", indicates that the following drawings were to be included but are not included in the package:

- E-601, "Electrical Lighting Fixture Schedule"
- E-602, "Electrical Panel Schedules"

Please provide.

Answer: **Please see revised Appendix in the amendment.**

23. Appendix A, package Fuel Operators Building, Drawing G-001, "Cover Sheet", indicates that there are 22 drawings but only the first 5 were included in the package. Please provide the remaining 17.

Answer: **Please see revised Appendix in the amendment.**

24. Appendix A, package Trash Collection Point, Drawing G-001, "Cover Sheet", indicates that the following drawings were to be included but are not included in the package:

- S-801, "FDN/SOG & roof Framing Plan"
- S-802, "Building Section"

Please provide.

Answer: **Please see revised Appendix in the amendment.**

25. Appendix A, Drawing C-02, "Concept Plan", shows Building #102, "Officers Barracks – Large", as dashed lines. Is this building required to be constructed under this contract or is it a future requirement?

Answer: **Please see revised Appendix in the amendment.**

26. Appendix A, Drawing C-02, "Concept Plan", List of Facilities indicate one (1) Facility #015, "Flagpole Location (3 Poles Total)" but there are two (2) Facilities #015 shown on the drawing – one on the east side of #001, "Parade Field", and the other south of #100, "Batallion Headquarters Building". Are one or two sets of flagpoles required?

Answer: **Please see revised Appendix in the amendment.**

27. Appendix A, Drawing C-02, "Concept Plan", shows the inner perimeter road as "3.5m Wide Asphalt Paved Road" and the outer perimeter road as "3.0m Wide Asphalt Paved Road". However, Section

01010, "Scope of Work", Part 5.3.1, "Roads" states "The Contractor shall design and construct 3.5 m wide (one lane) roads inside and outside the perimeter wall as shown on the Concept Plan. The one lane perimeter roads shall be surfaced with coarse aggregate." Please clarify the width and type of roads required for these two roads.

Answer: **Please see revised Appendix in the amendment.**

28. In Section 01010-14 Paragraph 5.3.1, it is stated that 'The one lane perimeter roads shall be surfaced with coarse aggregate'. However it is understood that the perimeter road shall be paved with asphalt (3.5 m wide asphalt paved road) in Concept Plan C-02 & C-03. Could you please clarify the pavement type of perimeter road (asphalt or aggregate).

Answer: **Please see revised Appendix in the amendment.**

29. In Section 01010/ Para 3.15, it is mentioned that 'The Contractor shall construct one (1) Class II O & M storage facility'. According to Para 3.15 and Drawing C-02 Concept Plan, we understand that Class II O & M Facility is an open fence enclosed area. Therefore we will be pricing only the aggregate surfaced (min 100 mm thick) area, chain link fence, two (2) double swing arm gates and two (2) personnel gates for Bid Item 0002AQ Class II O & M Facility. Could you please clarify any building is included in Bid Item 0002AQ or not? If yes, please provide concept drawings and details for this building.

Answer: **There are no Buildings in the Class II O&M Facility.**

30. Referring to para.3.2 scope of work & bid schedule item no.0002AV, it is stated that the contractor shall construct six flagpoles structures while referring to appendix part 1 drawing no. C-02 there are three flagpoles structures located in the parade field please advice the total correct no. of flagpoles.

Answer: **The Contractor shall construct 6 flag poles, three (3) at the parade field and three (3) at the Head Quarters Building (Bldg. 100 on the Concept Plan).**

31. Referring to Headquarter drawings, there is a conflict between the finish schedule (for ceiling finish type) (A-603) and the reflected ceiling plan (A-102), please clarify which one is correct.

Answer: **Space No. 105 = Finish F**

Space No. 107 = Finish F

Space No. 108 = Finish F

Space No. 109 = Finish A, B

32. Referring to Officer Barracks drawings there is a conflict between the finish schedule (for toilet room finish type) (A-603) and the detailed drawing for toilets (A-504,505), please clarify which one is correct.

Answer: **The contractor shall use the details on sheets A-504 and A-505 to develop a price for this CLIN.**

33. Referring to the Scope of work section 01010 Para 3.1 and Standard design drawing (E-501), please clarify if it is required from contractor to provide any backup Generator for Battalion Headquarters or not.

Answer: **On this project backup Power is required for the WWTP and the refrigerated storage at the DFAC, Please see revised section 01010 in the amendment.**

34. Referring to the Scope of work section 01010 Para 3.17, please confirm that it is not required from contractor to provide any backup Generator for Medical Clinic.

Answer: **No backup power is required for this facility.**

35. Referring to the Scope of work section 01010 Para 3.15, please clarify if it is required to provide any electrical work such as exterior lighting for Class II O&M Facility or not.

Answer: **No lighting or electrical is required for the Class II O&M Facility.**

36. Referring to the Scope of work section 01010 Para 3.18, please clarify if it is required to provide any electrical work such as exterior lighting for Convoy Assembly Area or not.

Answer: **None required**

37. Referring to the Scope of work section 01010 Para 4.1, please clarify if it is required to provide any electrical work such as exterior lighting for Perimeter Wall or not.

Answer: **None required.**

38. Referring to the Scope of work section 01010 Para 5.3 & 5.3.1 and Technical Requirement section 01015 Para 8.5.1, please clarify if it is required to provide any electrical work such as exterior street lighting for Roads or not.

Answer: **None required**

39. Referring to the Technical requirements Section 01015 Para 8.5.1, please clarify if exterior street lighting is in contract scope of work or not and if answer is Yes, please clarify on site layout which roads of overall project layout are required to be provided with exterior lighting.

Answer: **Street lighting is NOT required.**

40. Referring to section 01010 Para# 3.13.1 is the contractor is responsible to provide an air compressor or not. If yes please provide all required data and parameters.

Answer: **Air Compressor shall be supplied by the contractor according to the specifications in Section 01015, paragraph 6.10.2.**

41. There is a conflict between section 01010 Para# 5.10 and section 01015 para#2.4.4.2 about the WWTP capacity, Please confirm that the correct capacity is 150,000 liters per day.

Answer: **Please see revised paragraph 2.4.4.2, Section 01015 of the amendment.**

42. Referring to section 01015 Para#6.13.3, Please advice if the contractor can provide propane cylinders which are available in the local market instead of propane storage tank.

Answer: **The contractor shall provide propane tanks and facilities according to the standard drawings in the Appendix.**

43. Referring to section 01010 Para# 3.14.3, Please clarify if the contractor is responsible to provide separate water storage tank and water booster pump in the wash rack.

Answer: **Yes**

44. Referring to section 01010 Para# 3.14.3, please advice if a pressure washing machine is required for each bay of the wash rack.

Answer: **Yes**

45. Although it is not mentioned in Section 01010/ Para 3.1, we understand that the contractor will provide a backup generator (100 kW) in accordance with the HQ Bldg Drawing No: E-102. Could you please clarify whether a backup generator is required for the Battalion HQ Bldg or not?

Answer: **Not required**

46. The specifications contain the following information:

1. Design population : 801 personnel according to section 01010-1 scope of work
Project description
2. Design clean water requirement (according to design requirements 2.4.1.1) to be :
801 (personel) times 190 l/day per capita times 1,5 (CF)= 228 cum/day
3. As for WWTP according to the scope of work section 01010-17/ 5.10 the capacity of
WWTP 150.000 lt/day
4. But according to the design requirements 2.4.4.2. 930.000lt/day times 2 (200
% of flow)

The difference between 930 x 2 cum/day and 150 cum/day for WWTP seems to be an error. Please clarify

Answer: **Please see answer to # 13 above**

(End of Summary of Changes)

SECTION 01010 SCOPE OF WORK

1. PROJECT DESCRIPTION

This project consists of the design and construction of Afghan National Army Camp Deh Rawood/Hadrian 1/4/205th Infantry Kandak in Deh Rawood, Uruzgan Province, Afghanistan. The project includes buildings and facilities that shall be designed and constructed using Arch-Span and CMU construction methods according to the standard designs in the Appendix. The project is defined as the design, materials, labor, and equipment to construct buildings, roads, utilities, and other infrastructure to accommodate a garrison with a design population of 801 personnel.

The project consists of a new Infantry Kandak, and other common facilities for the garrison including a waste water treatment plant, support facilities, utilities and infrastructure as applicable.

The Contractor shall coordinate planned work with existing or future work by other contractors. The coordination effort may be significant and include exchanging design data, drawings, calculations, technical details and other information. Additionally, the Contractor will be required to document the coordination through meetings, teleconferences, and/or the submittal of additional information for the Construction Officer (KO). All coordination shall be in agreement with the KO and approved prior to the commencement of any work.

All work within this solicitation shall be designed and constructed in accordance with the current International Building Code (IBC), Life Safety Codes (NFPA-101), force protection and security standards.

1.1 CONSTRUCTION PRIORITY

All work required under this contract shall be completed within 365 calendar days including government review time from the Notice to Proceed.

The order of construction for all buildings and facilities are prioritized as follows.

During the construction phase of the project the contractor shall follow the Construction Priority Table and the requirements specified in Section 00150. All work under this contract shall be completed and buildings ready for beneficial occupancy in accordance with the Construction Priority Schedule. The Required Period of Performance is stated in Days following the NTP in the Table below:

Construction Priority Table	
Priority	Priority Construction Shall Be Completed By:
1	180 Days After NTP
2	365 Days After NTP

The Contractor shall provide accommodation for a minimum of two hundred and fifty (250) soldiers within 180 days from the NTP.

1.2 ENGLISH LANGUAGE REQUIREMENT

All information shall be presented in English. The Contractor shall have a minimum of one Englishspeaking representative to communicate with the COR at all times when work is in progress.

1.3 CQM TRAINING REQUIREMENT

The Contractor's Quality Control (QC) Manager is required to complete the U.S. Army Corps of Engineers (USACE) Construction Quality Management (CQM) course or equivalent as soon as available. The CQM course will be offered periodically by the USACE Transatlantic South District (TAS), Kandahar, Afghanistan. If the QC Manager has not completed the course, then he shall apply for the first available class after the award of the task order. Additional approved CQM courses include those offered by the Commercial Technical Training Center (in

Jalalabad) and the Champion Technical Training Center (in Kabul). The Quality Assurance Branch of the TAS can provide information related to TAS offerings of the CQM course, as well as contact information for training centers. Alternative CQM courses, other than those mentioned above, must be approved by the Quality Assurance Branch.

The Contractor's quality control plan, as defined in USACE Guide Specification 01451, entitled "Contractor Quality Control" (CQC), shall include "The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function." For the QC Manager, qualifications must include a certificate demonstrating completion of an approved CQM course. In lieu of a certificate, provide date of enrollment for the next CQM course.

1.4 SUBMITTALS

Submittals and a Submittal Register are required as specified in Section 01335.

1.5 LOCATION

All work under this contract is for the design and construction of Camp Deh Rawood/Hadrian in Uruzgan Province, Afghanistan. The project coordinates can be found on the Location Plan in the Appendix.

1.6 GENERAL REQUIREMENTS FOR FACILITIES

All requirements set forth in the Scope of Work (01010), but not included in the Technical Requirements (01015), shall be considered as set forth in both and vice versa.

In general, this project consists of designing and constructing facilities as described in this Section, the Concept Plan, standard design Arch-Span and CMU type building designs in the Appendix and the requirements stated in Section 01015 - Technical Requirements. The USACE construction representative shall be notified immediately of any inconsistencies discovered in this document.

All construction of the Standard Building designs identified in the Appendix of this document shall be done in strict accordance with the plans and specifications that are furnished, with no changes made to any feature of work shown in these design drawings and specifications, unless otherwise specified. All standard construction amenities such as underground utilities, site grading, plumbing, heating, and electrical, etc. shall be implied as a design and construction requirement. The Contractor shall provide potable water, toilets, ablution areas, electrical, and communications service backbone in buildings as specified, connecting to and integrating with existing systems and shall be responsible for installing all upgrades. Specification of equipment and materials that match stocked items by the facility or central Department of Public Works is highly desirable. The Contractor shall reference the Appendix for building specific construction details. All materials and equipment shall be standard product from a manufacturer regularly engaged in the manufacture of the product and shall duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

The Contractor shall match existing on-site architectural materials and colors. All construction shall be done in the same style and paint schemes as existing buildings, respective of sustainable construction and design except as indicated. All paint and materials shall be approved by the Contracting Officer prior to construction/installation of the paint and material.

All toilets shall be eastern style and shall face north or south.

The Contractor shall provide boot scrapers for boot cleaning at all building ingress/egress points. Barracks shall be spaced as far apart from each other as possible given the final site design configuration, as to minimize sound propagation and to increase privacy. All other design work not specifically identified in this document shall be the responsibility of the Contractor and it shall be submitted for review in accordance with Section 01335 of this document.

1.6.1 LIFE SAFETY

All facilities in this project shall meet all safety requirements as required in the references. A fire sprinkler system is not required. The Contractor shall equip buildings with wall-mounted A-B-C 6 kg fire extinguishers at a 1:100 SM density (minimum). Exit signs shall be placed above doors opening to the exterior and labeled in English,

Dari, and Pashto. The Contractor shall install hardwired smoke detectors that provide a local alarm only. Install carbon monoxide (CO) monitors in large occupancy areas (15 SF per person or greater occupant density) and sleeping areas. These CO monitors/alarms shall be hardwired for reliability and to prevent pilferage. For other requirements, refer to Section 01015.

1.6.2 INTERIOR LIGHTING

General lighting shall be provided for each building type and function within each building, in accordance with standard drawings in the Appendix. For any design features that the contractor is responsible for, the contractor shall adhere to the requirements in Section 01015.

1.6.3 HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

Environmental control of the facilities shall be achieved by natural ventilation, mechanical ventilation, and heating per the standard drawings in the Appendix. Cooling shall be provided in only specified rooms of specified buildings. In the case of facilities to be designed by the Contractor, for inside design conditions, air cooling and heating requirements, see Section 01015.

1.7 UNEXPLODED ORDNANCE (UXO)/MINES

The Contractor **IS NOT** responsible for the clearance or removal of mines and unexploded ordnance (UXO) from the site prior to the commencement of construction. The site has been cleared to a depth of 1.0 m (40") and the certificate of clearance is available for review. No construction activities are to be conducted without review of the written clearance certification for the site. If sub-surface construction activities will be performed on this site the clearance certification must state that the clearance depth was conducted to a minimum 1.0 m (40") in depth.

NOTE 1: For previous UXO/mine information, and a copy of the clearance certification the following points of contact from the UN Mine Action Center of Afghanistan are provided:

Mohammad Sediq, Chief of Operations
mohammad.sediq@macca.org.af
+93 (0)705 966 400 and +93 (0) 700 295 207

Mr. Mullah Jan
MACCA Senior Operations Manager
Mullah.jan@macca.org.af
+93 (0) 700 295 207

UXO Safety/ Mine clearance COR, USACE
tan.uxo.demining.safety@usace.army.mil,
Jeffrey Helmick USACE OESS/COR Mine Clearance AES
jeffrey.a.helmick2@usace.army.mil
Roshan: 079-403-1452
Comm: 540-723-6129

Marty Holmes USACE OESS/ACOR Mine Clearance AES
01010 - 4
Roshan: 079-752-9684
Comm: 540-667-6359

NOTE 2: For construction in excess of 1.0 m (40") in depth on areas previously cleared. If the contract parameters for sub-surface construction exceed the minimum 1.0 m (40") clearance depth the Contractor WILL be responsible for clearance to these depths.

The Contractor may only provide clearance/removal services via UN Mine Action Center for Afghanistan (UNMACA) accredited entities and Clearance/removal may only be undertaken in accordance with International Mine Action Standards (IMAS), Afghanistan Mine Action Standards (AMAS), and applicable U.S. Army Corps of Engineer (USACE) Ordnance & Explosives (OE) safety standards.

The Contractor will provide a standard UXO/Demining safety work plan to the US Army Corps of Engineers UXO / Demining COR for review prior to commencement of all UXO clearance/demining activities on the project sites. Once the UXO/ Demining clearance has concluded, the Contractor shall provide the US Army Corps of Engineers UXO / Demining COR a clearance certificate for review and approval before any construction activities are to commence.

It is the responsibility of the Contractor to be aware of the risk of encountering UXO/mines and to take all actions necessary to assure a safe work area to perform the requirements of this task order. The Contractor assumes the risk of any and all personal injury, property damage or other liability arising out of or resulting from any Contractor action taken hereunder. The Contractor and its subcontractors may not handle, work with, move, transport, render safe, or disarm any UXO/mine, unless they have appropriate accreditations from the MAC.

If a UXO/mine is encountered during project construction, the Contractor shall immediately stop work in the affected area, mark the area of the UXO/Mine and immediately notify the Contracting Officer, COR or the Government Construction Representative. UXO/Mine disposal will not be the responsibility of the Contractor unless the area exceeds the 1.0 m (40") clearance depth of the original clearance certificate.

2. SUMMARY OF WORK

2.1 MOBILIZATION/DEMOBILIZATION

Mobilization and Demobilization shall consist of all labor, equipment, supplies and facilities required to stage all equipment and facilities needed for construction of this project. All mobilization and staging areas shall be located within the limits of work or shall be coordinated with the Contracting Officer. The location of all mobilization and staging areas is the responsibility of the Contractor. See Contract Clauses for further information.

The Contractor shall install temporary access points and roads, temporary parking, construction lay-down areas, and foot paths with compacted base, appropriately graded for drainage, and covered with a well graded, crushed stone aggregate surface capable of withstanding the anticipated construction traffic. At a minimum, the Contractor shall place 50 mm of crushed, well-graded, and compacted aggregate over areas to be used for drainage, pedestrian circulation (not including foot paths), and/or dust control.

Portable latrines: During construction, the Contractor shall furnish and install portable latrine units in locations as required. Portable latrines shall be a mix of western and eastern style units. Mix shall be determined by Contracting Officer.

Portable lavatories: During construction, the Contractor shall furnish and install hand wash units in locations as required. Hand wash units shall each include four (4) wash units. Each wash unit shall consist of a basin, foot controlled wash water dispenser, hand soap dispenser, and towel dispenser.

This portion of the project shall be paid for under bid item, Mobilization/Demobilization, in the Bid Schedule.

2.2 SECURITY

Security is critical to construction in Afghanistan, especially on roads and remote areas away from Coalition Force bases. The Contractor must have an appropriate amount of security/protection to match the threat in the project area, outside of the perimeter fence, and along the supply routes. A detailed security plan in accordance with Section 01040 SECURITY shall be approved by the Government before construction notice to proceed.

The Contractor shall be responsible for physical security of all materials, supplies, and equipment of every description, including property which may be Government-furnished or owned, for all areas occupied jointly by the Contractor and the Government, as well as for all work performed.

This portion of the project shall be paid for under bid item, Security, in the Bid Schedule.

2.3 SITE SURVEY / EXISTING CONDITIONS MAP

The site survey and existing conditions map shall consist of all labor, equipment and supplies necessary to produce the topographical data in accordance with the requirements specified in Sections 01015 and 01335.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the contract shall be paid for under bid item, Site Survey/Existing Conditions Map, in the Bid Schedule.

2.4 ENGINEERING

The Contractor shall design all features of the project that are not included in the standard design drawings in the Appendix. All drawings shall be submitted in accordance with the requirements specified in Section 01335 and 01780A.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Engineering, in the Bid Schedule.

2.5 GEOTECHNICAL INVESTIGATION

Existing geotechnical information is not available for the project site. Any site-specific geotechnical data required to develop foundations, fill at elevated slabs, materials, earthwork, roads, and other geotechnical related design and construction activities for this project shall be the Contractor’s responsibility.

The geotechnical report shall contain the results of a geotechnical investigation conducted in accordance with the requirements specified in Section 01015. All labor, equipment and supplies necessary to conduct a geotechnical investigation shall be considered a part of the this item.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Geotechnical Investigation, in the Bid Schedule.

2.5.1 FOUNDATION DESIGN

As part of the Geotechnical Investigation line item the Contractor shall evaluate the Standard Building designs foundation designs attached in the Appendix. Foundations, including sub-grade, are based on an assumed soil bearing value for standard building designs. The Contractor shall confirm the assumed soil bearing capacity based on the geotechnical investigation. If the assumed soil bearing capacity is inadequate for the standard designed foundations, the Contractor shall design appropriate foundations using the recommendations from the Geotechnical Investigation

2.6 AS-BUILT DRAWINGS

The Contractor shall provide the Government with complete as-built drawings at the conclusion of the project. The bid item “As-Built Drawings” shall consist of all labor, equipment, and supplies needed to produce design records, documents and drawings in accordance with the requirements specified in Section 01335 and 01780A.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, As-Built drawings, in the Bid Schedule.

3. FACILITIES

3.1 BATTALION HEADQUARTERS

The Contractor shall construct one (1) Battalion Headquarters Building of Arch-Span type construction following the standard construction drawings attached in the Appendix – titled “Headquarters Building-Arch Span”. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

The Standard Drawings for this facility require back-up power, NO back up power is required for this facility on this project.

This facility shall be paid under bid item, Battalion Headquarter, in the Bid Schedule.

3.2 OFFICERS BARRACKS

The Contractor shall construct one (1) Officers Barracks; it shall be Arch-Span type construction and built according to the standard construction drawings in the Appendix – titled “Officers Barracks - Large”. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Officers Barracks, in the Bid Schedule.

3.3 NCO BARRACKS

The Contractor shall construct two (2) NCO Barracks; they shall be Arch-Span type construction and built according to the standard construction drawings in the Appendix – titled “NCO Barracks – Large”. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This facility shall be paid for under item, NCO Barracks, in the Bid Schedule.

3.4 ENLISTED BARRACKS

The Contractor shall construct four (4) Enlisted Barracks; they shall be Arch-Span type construction following the standard construction drawings in the Appendix – titled “Enlisted Barracks”. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Enlisted Barracks, of the Bid Schedule.

3.5 LARGE LATRINE

The Contractor shall construct one (1) Large Latrine Buildings; they shall be Arch-Span type construction following the standard construction drawings in the Appendix – titled “Latrine - Large”. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All toilets shall be Eastern Style and shall face North–South. Laundry sinks shall be hand-wash type with hose-bibb type faucets.

The Contractor shall provide three (3) 5.0 m long Clothesline units at each large Latrine Building, following the standard construction drawings in the Appendix.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Large Latrine, in the Bid Schedule.

3.6 SMALL LATRINE

The Contractor shall construct two (2) Small Latrine Buildings; they shall be Arch-Span type construction following the standard construction drawings in the Appendix - titled "Latrine-Small". The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All toilets shall be Eastern Style and shall face North-South.

The Contractor shall construct two (2) 5.0 m long Clothesline units at each Small Latrine Building according to the standard construction drawings in the Appendix.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Small Latrine, in the Bid Schedule.

3.7 TRAINING BUILDING

The Contractor shall construct one (1) Training Classroom Building; it shall be Arch-Span type construction following the standard construction drawings in the Appendix – titled "Training Building". The Contractor shall refer to the Concept Plan in the Appendix for the location of this facility.

This portion of the project has been assigned "Priority 2"; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Training Building, of the Bid Schedule.

3.8 MWR BUILDING

The Contractor shall construct one (1) MWR building per the standard design drawing titled "MWR Building-Arch Span" in the Appendix. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

This portion of the project has been assigned "Priority 2"; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid for under bid item, MWR Building, of the Bid Schedule.

3.9 BATTALION STORAGE BUILDING

The Contractor shall construct one (1) Storage Building; it shall be Arch-Span type construction following the standard construction drawings in the Appendix – titled "Storage Building". The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Storage Building shall be enclosed by a 3.0 m high chain link fence topped with a Y-channel and triple strand concertina wire. The fence shall have two (2) lockable double swing arm vehicle gates and two (2) lockable personnel gates. Refer to the Concept plan for the location and dimensions of the enclosed area labeled as, Outdoor Secure Storage. Install area lighting over the loading dock area. The fenced area shall have a 100 mm thick aggregate surface.

The Contractor shall construct the fence and gates per the fencing details attached in the Appendix.

This portion of the project has been assigned "Priority 2"; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Storage Building, in the Bid Schedule.

3.10 SMALL ARMS STORAGE

The Contractor shall construct one (1) Small Arms Storage Building; it shall be CMU type construction following the standard construction drawings in the Appendix titled "Small Arms Storage". The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Small Arms Storage building shall include the following:

- a. Wooden racks for storing long-arm weapons vertically. Racks shall not be furnished with locking bars.
- b. Power outlets in the walls no more than 4.0 m apart.
- c. The facility will be enclosed with a 3.0 m high fence and a secure entranceway. The fence shall be constructed according to the standard details for fences and gates in the Appendix.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Small Arms Storage, in the Bid Schedule.

3.11 AMMUNITION SUPPLY POINT

The Contractor shall construct one (1) Ammunition Supply Point (ASP) facility. The Contractor shall refer to the Concept Plan in the Appendix for the location of this facility.

The ASP shall have a safety setback radius of 75 m, as defined in the UFC guide lines. The ASP shall consist of 3 (three) securable conex containers (or equivalent) with dimensions 20ft X 8ft X 8ft. Around the perimeter of the ASP the Contractor shall provide double stacked 10 ft HESCO barriers (total height = 20 feet) with concertina wire on top, a double swing, lockable, access gate and a drop arm barrier at the entrance. The traffic surface inside the compound shall be 100 mm thick aggregate, elevated and graded for positive drainage. The Contractor shall allow for adequate vehicle maneuver space.

Area lighting shall be provided at each entry door, access gate and building corner. The lighting shall illuminate a 30 m radius minimum.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Ammunition Supply Point, in the Bid Schedule.

3.12 DFAC-SMALL

The Contractor shall construct one (1) Dining Facility; it shall be Arch-Span type construction following the standard construction drawings in the Appendix – titled “DFAC- Small”. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All quantities of stoves, wood burning stoves, sinks, and other equipment shall be as illustrated in the standard construction drawings and described in Section 01015.

The DFAC shall include, as a minimum, the following:

- a.) A service area in support of the DFAC building. The service area shall be surrounded with a 3 m high chain link fence with Y-channel and triple strand concertina wire and one (1) lockable double swing arm vehicle gate and two (2) lockable personnel gates. Construct the fence and gates per the standard fencing details in the Appendix. The location and dimensions for the service area shall be as shown on the Concept Plan in the Appendix labeled, DFAC Outdoor Yard. The service area shall be able to accommodate propane storage, wood stoves, wood storage area, and storage areas, area for the future location of trailers, and maneuver area. At a minimum 200 mm of aggregate shall be used to surface the service area.
- b.) A covered wood storage area shall be constructed in close proximity to the wood stoves and be fenced.
- c.) For a 30-day supply of fuel, provide four (4) bottles per cook stove.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

The fuel tanks shall contain a full supply of fuel when the facility is turned over to the Government.

This facility shall be paid for under item, DFAC-Small, in the Bid Schedule.

3.12.1 BACKUP POWER-DFAC

As part of the DFAC bid item the Contractor shall design and construct a backup power generator system for the refrigerated storage in the DFAC which is independent of the Kandak power plant. The Contractor shall ensure that the backup power generator system will accommodate the facility's power requirements. The backup power generator system shall provide fuel storage for the generator with capacity to provide 48 hours of continuous generator run time along with an electrical distribution system to the facility. Additional requirements for the backup power system are in Section 01015. The generator and the fuel storage shall be placed on a concrete pad with secondary containment capable of holding 110% of the fuel storage tanks volume. Additionally the generator/fuel storage station shall have a metal canopy over it to protect it from weather and prevent water from accumulating in the secondary containment.

3.13 MOTOR POOL AREA

The Contractor shall design and construct one (1) Motor Pool Area. The Motor Pool shall be located and sized as indicated in the Concept Plan attached in the Appendix. The Contractor shall use the design drawings titled 'Motor Pool Area' in the Appendix for information only when designing and building the Motor Pool.

The Motor Pool Area shall be enclosed by a 3.0 m high chain link fence topped with Y-channel and triple strand concertina wire. The fence shall have four (4) lockable double swing arm vehicle gates and two (2) lockable personnel gates. The Contractor shall construct the fence and gates following the standard details in the Appendix. The fenced area shall enclose the Fuel Point, Wash Rack, and vehicle maintenance area listed elsewhere in this section.

The design shall allow adequate vehicle maneuver space to access all parking and facilities. A 150 mm thick aggregate surface shall be installed in the fenced in motor pool area.

Exterior lighting at the Motor Pool shall be pole-mounted, along the fence line and sufficient to illuminate all areas in for nighttime operations.

This portion of the project has been assigned "Priority 2"; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid for under bid item, Motor Pool Area, of the Bid Schedule.

3.13.1 VEHICLE MAINTENANCE FACILITY

As part of the Motor Pool Area bid item the Contractor shall construct one (1) Vehicle Maintenance building; it shall be Arch-Span type construction following the standard construction drawings in the Appendix – titled "Vehicle Maintenance Building".

The Contractor shall refer to the Concept Plan for the location of this facility in relation to other facilities on the compound. Additionally, the Contractor shall follow all of the requirements in Section 01015 and include the following elements:

- a. There shall be a concrete hardstand apron outside all garage doors with a minimum width of 10 m. The apron shall be designed for HS20 loading.
- b. Emergency eye-wash stations shall be provided; one for every two (2) maintenance bays.
- c. Battery rooms shall have emergency eyewash stations and one (1) acid resistant sink.
- d. An air compressor shall be located outside and to the rear of the building under a canopy and enclosed in a security gate.

This portion of the project has been assigned "Priority 2"; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

3.13.2 POL STORAGE BUILDING

As part of the Motor Pool Area bid item the Contractor shall construct one (1) POL Storage Building following the standard construction drawings in the Appendix. The Contractor shall refer to the Concept Plan for the location of this facility in relationship to other buildings and facilities on site.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

3.14 VEHICLE REFUELING POINT

The Contractor shall design and construct one (1) Vehicle Fuel Point with fuel dispensers, fuel tanks, one (1) Operators Building and one (1) wash rack. The Contractor shall include sufficient area around the fuel point for vehicle maneuvering. The area around the fuel point shall be graded with appropriate slope and drainage shall tie into the storm drainage system.

The fuel point shall be designed to accommodate two (2) 7-ton vehicles side by side in accordance with the Concept Plan. Each refueling point shall have a metal roof canopy per the standard design in the Appendix. The Contractor shall provide fire extinguishers at each fuel dispenser.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid for under the bid item, Vehicle Refueling Point, of the Bid Schedule.

3.14.1 DISPENSERS AND FUEL TANKS

As part of the “Vehicle Refueling Point” bid item, the Contractor shall design, construct and install Dispensers and Fuel Tanks for a complete operational vehicle refueling facility. There shall be one (1) diesel and one (1) MOGAS fuel dispenser.

The concrete parking pad shall extend for the full length of the dispensing area as shown in the standard drawings. The Contractor shall provide a minimum of 5 gallons of spill containment at the tank fill connection, breakaway nozzles, gauging system and fire extinguishers. The Contractor shall design and construct area lighting for general illumination of the vehicle fuel dispensing area. All lighting and electrical devices shall be explosion-proof.

The Contractor shall design and construct a metal roof canopy for each fuel dispenser based upon the standard design in the Appendix.

The Contractor shall design and construct above-ground fuel tanks. Fuel Storage capacity shall be 50,000 liters of diesel fuel and 5,000 liters of MOGAS. The fuel lines shall be gravity feed and the fuel tanks shall have a sight glass or dipstick measuring system. Rubber hoses shall not be used. The storage tanks shall be single walled surrounded by a concrete spill containment structure that is 110% of the fuel tank capacity. The storage tanks shall have adequately protected distribution lines to the vehicle refueling points. The tanks shall be surrounded by concrete T-walls (Alaska barriers) and have a metal roof to keep precipitation out of the tank pit. The tank pit floor shall be flat to maximize evaporation. The dispensing meter shall be mechanical type.

Hot-dipped galvanized tanks or pipe in the fuel system shall not be used.

The Contractor shall provide a full supply of fuel to the tanks at the time of turnover to the Government.

3.14.2 FUEL OPERATORS BUILDING

As part of the Vehicle Refueling Point the contractor shall construct one (1) Fuel Operators Building following the standard construction drawings attached in the Appendix. The Contractor shall refer to the Concept Plan for the location of this facility in relationship to other buildings and facilities at the site.

3.14.3 VEHICLE WASH RACK

As part of the “Vehicle Refueling Point” bid item the Contractor shall design and construct a Vehicle Wash Rack to accommodate 2 (two) vehicles simultaneously. The Contractor shall refer to the Concept Plan for the location of this facility relationship to other buildings and facilities on the site. The Contractor shall refer to the Vehicle Wash Racks drawing in the Appendix for information only. The Contractor shall refer to Section 01015 for additional technical requirements. The Vehicle Wash Racks shall be provided with pressure washing service in both wash stalls. The elevated concrete pad shall have a broom finish texture and have the appropriate slope for drainage run-off to a trench drain. The Contractor shall extend drainpipes from the trench drain away from the

wash stations into grit chambers and an oil/water separator. The drain pipes shall have clean outs at appropriate locations. The drain shall ultimately tie into the facility storm drainage system.

3.15 CLASS II O & M FACILITY

The Contractor shall construct one (1) Class II O & M storage facility. The fenced areas of the Class II O&M Facility shall have an aggregate surface a minimum of 100 mm thick.

The Class II O & M storage facility shall be enclosed by a 3.0 m high chain link fence with Y-channel and triple strand concertina wire on top. The fence shall have two (2) lockable double swing arm vehicle gates and two (2) lockable personnel gates. The Contractor shall construct the fence and gates per the standard detail in the Appendix.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid under bid item, Class II O & M Facility, in the Bid Schedule.

3.16 TRASH COLLECTION POINT

The Contractor shall construct ten (10) trash collection points following the standard construction drawings titled “Trash Collection Point” in the Appendix. Place each Trash Collection Point in locations convenient for easy vehicular access. Trash points shall be evenly spaced around the facility, at each common facility and easily accessible by vehicle.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

These facilities shall be priced under bid item, Trash Collection Point, of the Bid Schedule.

3.17 MEDICAL CLINIC

The Contractor shall construct one (1) Troop Medical Clinic building; it shall be Arch-Span type construction following the standard construction drawings in the Appendix – titled “Medical Clinic - Small”.

The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site. The Contractor shall provide six (6) parking spaces located near the facility. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be paid for under bid item, Medical Clinic, in the Bid Schedule.

3.17.1 MEDICAL WASTE INCINERATOR

As part of the Medical Clinic bid item the Contractor shall design and construct a self-contained diesel fuel medical waste incinerator with a minimum burn rate capacity of 100 kg/day. The incinerator shall meet the specifications here and in Section 1015. The Incinerator shall be located near the Medical Center, the stand off distance from the building and other facilities shall be as recommended by the manufacturer.

The contractor shall provide training on the incinerator to appropriate ANA staff according to the ‘Operations and Maintenance for Mechanical’ paragraph in Section 01015.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

3.18 CONVOY ASSEMBLY AREA

The Contractor shall design and construct one (1) asphalt paved Convoy Assembly Area 100m long x 8m wide. The Contractor shall refer to the Concept Plan in the Appendix for the location. The assembly area shall accommodate two (2) parallel sets of vehicles parked in formation ready to exit the Kandak.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be priced under bid item, Convoy Assembly Area, in the Bid Schedule.

3.19 PARADE FIELD

The Contractor shall design and construct one (1) Parade Ground Review Stand and one (1) Parade Field. The Parade Field shall be 60m x 80m. The parade fields shall have a compacted base, be appropriately drained and graded, and surfaced with 100 mm of compacted and well-graded aggregate.

The Contractor shall construct the parade ground review stands according to the standard design drawings in the Appendix.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This facility shall be priced under bid item, Parade Field, of the Bid Schedule.

3.20 FLAGPOLES

The Contractor shall construct six (6) Flagpoles according to the standard details attached in the Appendix. The Flagpoles are located at the Head Quarters building and the parade field, as shown on the Concept Plan attached in the Appendix.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

These items shall be paid for under the bid item, Flag Poles, in the Bid Schedule.

4. FORCE PROTECTION

Construct force protection measures to include stone perimeter walls, guard towers, and personnel bunkers. Force protection requirements shall be in accordance with UFC 4-010-01, *Minimum DOD Antiterrorism Standards for Buildings*; and UFC 4-010-02, *DoD Minimum Anti-terrorism Standoff Distances for Buildings*. A standoff distance of 45 m is required for billeting and high-occupancy facilities.

4.1 PERIMETER WALL

The Contractor shall construct the perimeter wall in accordance with Section 1015 and the standard construction drawings attached in the Appendix. Refer to the Concept Plan for the general location.

The height of the walls shall measure 3.0 m from the inside and outside grades to the top of the concrete wall cap. The wall shall be topped with Y shaped outriggers and single-coil concertina style razor wire. The ground grade shall slope away from the wall for at least 5.0 m and shall be kept a minimum of 3.0 m below the top of wall for a minimum distance of 10 m. The wall shall be designed to prevent all pedestrian and vehicle traffic outside the compound from having a visual line of site into the compound.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Perimeter Wall, in the Bid Schedule.

4.2 ANTI-VEHICLE TRENCH

The Contractor shall design and construct an anti-vehicle trench per the standard design drawing titled “Anti-Vehicle Trench” in the Appendix. The Contractor shall slope the antivehicular trench to provide proper drainage. The Contractor shall construct the Anti-Vehicle Trench outside the perimeter wall using the Concept Plan in the Appendix as a reference for placement.

The anti-vehicle trench shall be protected from erosion using rip rap or concrete lining on the interior trench slopes (the slopes nearest to the compound) at a minimum and other slopes as needed.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid under bid item, Anti-Vehicle Trench, of the Bid Schedule.

4.3 GUARD TOWERS

The Contractor shall construct ten (10) Guard Towers per the standard drawings titled “Guard Tower” in the Appendix. The Contractor shall construct the guard towers at appropriate locations near the perimeter wall according to angle points, site lines, and elevations. The Contractor shall space the Guard Towers no more than 275 m apart.

The Contractor shall install manually operated 360-degree, omni-directional searchlight and communications at each guard tower. The guard towers shall be located such that the outside of the perimeter wall can be observed from two sides of the tower windows. The floor height shall be elevated as to allow the window sill to be 0.5 m above the top of the wall. The lights shall be positioned to provide overlapping coverage and to avoid illuminating guard positions. White lights shall not be used inside the Guard Towers. Red, blue, or black lenses for interior Guard Tower lighting shall be used.

The area in the immediate exterior vicinity of the Guard Towers shall be provided with an all weather nonslip surface and shall be graded to sufficiently drain away from structure.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Guard Towers, in the Bid Schedule.

4.4 PERSONNEL BUNKERS

The Contractor shall construct thirty (30) Personnel Bunkers according to the standard construction drawings in the appendix. The contractor shall verify all standards for size and quantities prior to bidding and choose locations to place bunkers based on personnel density and location.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid under bid item, Personnel Bunkers, of the Bid Schedule.

4.5 ENTRY CONTROL POINTS

The Contractor shall design and construct two (2) Entry Control Points (ECPs). Each ECP shall consist of two (2) manually operated drop arm barriers, one (1) manually operated steel sliding gate, one (1) personnel gate, one (1) covered canopy, one (1) guard shack, Jersey barriers, and an inspection/rejection area and turn out lane.

The Contractor shall install floodlights at the guard shack to illuminate the entrance and inspection/rejection area for force protection personnel at the gate. The contractor shall construct the drop arm barriers, sliding gate, covered canopy, and guard shack per the standard design drawings in the Appendix.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Entry Control Points, in the Bid Schedule.

5. SITE DEVELOPMENT/IMPROVEMENTS

5.1 DEMOLITION

The Contractor shall remove and dispose of all debris, trash, concrete, unused fences, buildings, existing utilities above or below ground, fuel tanks, HESCO baskets, and foundations. The Contractor shall be responsible for finding a location and paying all fees associated with removal and relocation of all debris off the installation. The debris disposal location shall be verified with the COR. Scrap metal on site shall be moved to an area away from the site perimeter as directed by the COR and left for the host government to salvage. Demolished fencing and

concertina wire shall be neatly rolled up and used fence posts and outriggers shall be neatly stockpiled for reuse by the host government All demolition requirements shall be determined by the Contractor.

Note: The Contractor shall demolish and remove the existing perimeter wall, conex containers, guard tower and Hesco baskets at a minimum from the site. The approximate locations of some of the existing items to be removed/demolished are shown on the Concept Plan in the Appendix.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be priced under bid item, Demolition, of the Bid Schedule.

5.2 SITE GRADING AND STORMWATER MANAGEMENT

Site grading and drainage features shall conform to the requirements and references specified herein for development of the facility. The Contractor shall design and submit a Site Grading and Drainage Plan. Site grading shall be compatible with existing terrain/grading, provide adequate drainage to minimize flooding, and promote drainage to the nearest wadi or adequate drainage ditch.

The Grading and Drainage Plan shall be properly contoured showing existing and proposed contour lines, location and details of all drainage structures and show direction of flow in drainage swales and ditches. There shall be spot elevations shown at the beginning and end of all drainage structures, at inflection points, and spaced every 25 meters along the alignment. Proposed contour lines shall meet with existing contour lines on the Grading and Drainage Plan. The Grading and Drainage Plan shall be at a scale such that all lines and structures can be easily seen and ascertained.

The anti-vehicle trench on the perimeter of the site (see Concept Plan in the Appendix) shall be used as the perimeter drainage ditch. The standard detail for the anti-vehicle trench in the Appendix shall be modified to accommodate the storm flows from off site. The anti-vehicle trench standard detail in the Appendix shall be the smallest cross section constructed; the Contractor shall widen or deepen the anti-vehicle trench as necessary for drainage purposes. The antivehicle/drainage trench shall be sloped to provide positive drainage to an offsite wadi/drainage ditch.

At locations where drainage ditches cross the perimeter wall, new concrete culverts shall be installed to manage the wastewater and stormwater flows. The culverts shall include personnel access denial system(s). The installation of culverts, sized for maximum stormwater flows, shall be required at all road and walkway locations which cross drainage ditches. All culverts outside of the perimeter wall shall include personnel access denial system(s).

The sides of all new earthen storm drainage (including canals, trenches, ditches, swales, etc) except the anti-vehicle trench shall not have a slope greater than 1 Vertical: 3 Horizontal. Storm drainage features with greater slopes must be lined with a stone and mortar finish or concrete lined to prevent erosion.

All drainage shall be conveyed off site; stormwater retention shall not be allowed as a drainage solution.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Site Grading and Storm water Management of the Bid Schedule.

5.3 ROADS AND FOOTPATHS/FIRE LANES/PARKING

The Contractor shall design and construct the entire road network based on the results from the Contractor's geotechnical investigation. Except for the perimeter access roads, all roads shall be asphalt paved.

The road layout shall provide ease of access to entrance points, buildings, loading ramps and docks, vehicle maintenance facilities, fuel points, trash collection points, grease traps, oil/water separators, etc.

This portion of the project has been assigned "Priority 2"; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Roads and Footpath/Fire lanes/Parking in the Bid Schedule.

5.3.1 ROADS

As part of the “Roads and Footpaths/Firelanes/Parking” bid item, the Contractor shall design and construct two-lane, 7.3m wide asphalt paved roads within the proposed development. The Contractor shall design and construct 3.5 m wide (one lane) roads inside and outside the perimeter wall as shown on the Concept Plan. The one lane perimeter roads shall be surfaced with coarse aggregate. Roads and parking lots shall be designed for HS-20 loading. A storm drainage system shall also be included.

Roads shall be sloped for proper surface runoff. Drainage ditches are required on both sides of the road; ditches shall be connected to a drainage network that shall convey drainage offsite. The hydrology of the area shall be evaluated to determine drainage ditch and structure sizes.

The Contractor shall provide design drawings showing detailed cross sections and road structure and plan and profile drawings showing proper stationing to comply with the Technical Requirements, Section 01015.

5.3.2 FOOTPATHS/FIRELANES

As part of the “Roads and Footpaths/Firelanes/Parking” bid item, the Contractor shall design and construct 1.5 m wide concrete foot paths. Foot Paths shall have a compacted base, be appropriately graded for drainage, and covered with a concrete surface. The concrete footpaths shall be required to connect all buildings, facilities, and features such as offices, classrooms, billeting, etc. Footpaths shall be shown on the Site Plan and a detail of the foot paths shall be provided in the design drawings.

The Contractor shall design and construct firelanes on a minimum of three (3) sides of all buildings. Fire lanes shall be a minimum of three (3) meters wide and paved with a minimum of 150 mm of concrete paving. Footpaths may be used as firelanes if the footpath is a minimum of 3.0 m wide. All footpaths that are used as firelanes shall be concrete paved.

5.3.3 PARKING

As part of the “Roads and Footpaths/Firelanes/parking” bid item, the Contractor shall design and construct parking for individual facilities based on the Concept Plan and on the parking requirements for each facility. Parking shall be surfaced with coarse aggregate. Parking adjacent to roadways shall have drainage culverts passing underneath. Parking spaces and geometry shall be shown on the site plan.

5.4 WELL DRILLING

The Contractor shall locate a well site and drill one (1) well a minimum of 100 meters and a maximum of 200 meters below ground surface in an attempt to find potable water meeting the demand requirements of 801 personnel. The water from the wells shall be tested and accepted by meeting the World Health Organization quality standards for human consumption. If water cannot be found the Contractor shall immediately notify the COR. If the Contractor drills to 200 meters and meets all requirements of this solicitation and water is not found, the Contractor will be considered to have fulfilled the terms of the contract and will be entitled to the full price of the contract CLIN for “Well Drilling”.

The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid under bid item, Well Drilling in the Bid Schedule.

5.5 WELL HOUSE AND SYSTEM

The Contractor shall design and construct an enclosed well house, flow meters, well pumps and a disinfection system for each well according to the standard construction drawings in the Appendix and the requirements in Section 01015. Exterior lights shall be installed, either mounted to the side of the building or on poles. The

Contractor shall refer to the Concept Plan for the location of this structure in relationship to other buildings and facilities on site.

FENCES: Surrounding the entire potable well house and system (pumps, tanks etc.) shall be a 3 m high chain link security fences with Y-channel and triple strand concertina wire with one (1) lockable personnel gate for the backup generator building, one (1) lockable double swing arm gate and one (1) personnel gate for the well and pump house building. The fencing shall be offset 3m from the exterior walls of the buildings. Construct the fencing and gates per the Fencing Details provided in the Appendix.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid under bid item, Well House and System, in the Bid Schedule.

5.6 BOOSTER PUMP SYSTEM

Booster pumps and hydro pneumatic tanks shall provide the necessary pressure in the water system. The Contractor shall construct a Booster Pump Station and Building according to the standard drawings in the Appendix and the requirements in Section 01015. The Contractor shall refer to the Concept Plan for the location of this structure in relationship to other buildings and facilities on site.

FENCES: Surrounding the backup generator system and booster pump building(s) shall be a 3 m high chain link security fences with Y-channel and triple strand concertina wire with one (1) lockable personnel gate for the backup generator building, one (1) lockable double swing arm gate and one (1) personnel gate for the booster pump house building. The fencing shall be offset 3m from the exterior walls of the buildings. Construct the fencing and gates per the Fencing Details provided in the Appendix.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid under bid item, Booster Pump System, of the Bid Schedule.

5.7 WATER STORAGE TANK(S)

The Contractor shall design and construct circular steel or circular concrete ground level storage tank(s) (GSTs) located near the water well(s) with a minimum capacity of 560,000 liters. Storage tank(s) and piping shall be heated to prevent freezing of the tank and pipes entering the tank. A system of heat wrapped tape and exterior tank insulation is not considered a feasible permanent insulation system as it does not conform to a twenty (20) year life expectancy. The storage facility shall be located above drainage areas and locations subject to flooding as approved by the Contracting Officer or his representative. The storage facility shall be located at the higher elevations of the site to promote gravity flow and reduce pumping requirements. Overflow and air vents shall be screened so that birds, insects, rodents and debris cannot enter the reservoir. The Contractor shall provide pipe of adequate strength and durability with no adverse effect on water quality. The pipe shall be corrosion resistant.

Exterior area lights shall be installed, either mounted to the side of the building or on poles. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid under bid item, Water Storage Tank(s), in the Bid Schedule.

5.8 WATER DISTRIBUTION SYSTEM

The Contractor shall design and construct a distribution system shall include all required piping, valves, fittings, and appurtenances required to serve water to all facilities requiring it. The Water system must be fully looped.

The Contractor shall design and construct a potable water distribution system for a population of 801 in accordance with the AED Design Requirements, latest version. See Section 01015 for design and construction criteria. Water requirements for fire fighting, irrigation and landscaping shall not be included in design demand calculations.

The water system shall include connections between water well(s), well pump(s), disinfection station(s), well/pump house(s), water tank(s), booster pumps, hydro pneumatic surge tank(s), booster pump building(s) and underground pipe distribution system with service connections to all buildings and features requiring water supply. The Contractor shall install totalizing flow meters between the water well and storage tanks and between the storage tanks and the distribution system.

All materials, finishes, and equipment shall comply with the requirements of Section 01015.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid under bid item, Water Distribution System, of the Bid Schedule.

5.9 WASTEWATER COLLECTION SYSTEM

The Contractor shall design and construct a sanitary sewer collection system for all facilities that require it.

The sanitary waste water collection system shall consist of gravity sewer pipe and appurtenances such as manholes, cleanouts, building service connections and lift station(s). See Section 01015 for technical requirements.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Wastewater Collection System, in the Bid Schedule.

5.10 WASTEWATER TREATMENT PLANT

The Contractor shall design and construct a wastewater treatment plant according to the requirements in Section 01015.

The wastewater treatment plant (WWTP) shall be a partial mix aeration lagoon system that has features including but not limited to a lift/pump station (if necessary), headworks, aeration pond, settling pond, sludge drying lagoons, and chlorine contact tank. In addition the Contractor shall design and construct a support building(s) for lab/office/storage space. The capacity of the wastewater treatment plant shall be 150,000 liters per day. Refer to the Site Concept Plan attached in the Appendix for the general location of the WWTP. The waste water treatment lagoon system shall be designed and constructed such that the system shall not be flooded by a 20-year storm event and shall include considerations for potential flooding events originating upstream.

The Contractor shall design and construct an approximately 14 m² CMU chemical feed/storage building as part of the waste water treatment plant. The chemical feed/storage building shall contain all hypochlorite system components and space for chemical storage. The chemical feed/storage building shall be adequately ventilated to prevent accumulation of chemical off gases. The Contractor shall provide a hose bib in the building and floor drain. The Contractor shall provide lighting per Section 01015. The exterior finish shall be stucco per Section 01015. Interior Construction: The interior wall surfaces shall be painted plaster. No painted plywood or other wood panel product shall be used. Metal roofing on an overbuilt structure shall be used. The slope of the roof shall be a minimum of 2V:10H. The exterior door and frame shall be galvanized with a factory applied finish. Provide four (4) aggregate surfaced vehicle parking spaces. Provide aggregate surfaced driveways and driving lanes as necessary.

The wastewater treatment plant shall be surrounded with a 3 m high chain link security fence with Ychannel and triple strand concertina wire on top. The fence shall have one (1) lockable personnel gate and two (2) lockable double swing arm gates. The fencing shall be offset a minimum of 8 m from the exterior walls of buildings and other wastewater treatment plant facilities. Construct the fencing and gates per the Fencing Details provided in the Appendix.

WWTP Outfall: The Contractor shall design and construct a gravity or force main outfall pipe from the waste water treatment lagoon system to the nearest wadi. The Contractor shall design the outfall pipe to adequately flow 150,000 liters per day accounting for peak flows. The outfall pipe shall be reinforced concrete pipe and be designed for HS-20 loading.

This portion of the project has been assigned “Priority 1”; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item; WWTP in the Bid Schedule.

5.10.1 BACKUP POWER-WWTP

As part of the Waste Water Treatment Plant bid item the Contractor shall design and construct a backup power generator system for the WWTP which is independent of the Kandak power plant. The Contractor shall ensure that the backup power generator system will accommodate the facility’s power requirements. The backup power generator system shall provide fuel storage for the generator with capacity to provide 48 hours of continuous generator run time along with an electrical distribution system to the facility. Additional requirements for the backup power system are in Section 01015. The generator and the fuel storage shall be placed on a concrete pad with secondary containment capable of holding 110% of the fuel storage tanks volume. Additionally the generator/fuel storage station shall have a metal canopy over it to protect it from weather and prevent water from accumulating in the secondary containment.

5.11 GREY WATER IRRIGATION SYSTEM

The Contractor shall design and construct a grey water irrigation system for irrigation purposes throughout the proposed development.

The grey water irrigation system shall consist of an underground pipe distribution system, service connections, and necessary appurtenances along all vehicle circulation routes, major open areas, football/parade fields and any other features requiring irrigation. The Contractor shall install one spigot every 100 meters for access to grey water irrigation. All spigots shall be encased in a sub-surface utility box to avoid being damaged by standard base traffic. Spigots shall be clearly marked “Irrigation Only-Do Not Drink” in Dari, Pashtu and English.

This portion of the project has been assigned “Priority 2”; the period of performance for the work in this paragraph shall be as stated for Priority 2 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Grey Water Irrigation System, in the Bid Schedule.

5.12 POWER PLANT

Prime Power Plant: The power plant must be designed and constructed to accommodate one (1) additional generator for future expansion.

The Contractor shall design and construct one (1) outdoor central power plant for power supply to all facilities requiring power on the Kandak. The Contractor shall provide a concrete slab and metal canopy sized to contain the required generators and their associated switchgear, equipment, and all appurtenances necessary to meet all power requirements. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

Generator Pads and Fuel Storage: The contractor shall design and construct fuel storage sized to store a 30 day supply. Fuel storage shall have secondary containment with a flat bottom to maximize evaporation. The fuel storage area must be designed to accommodate one (1) additional tank for future expansion at the power generation facility.

Fuel for commissioning and testing shall be provided by the Contractor. Also, the Contractor shall provide fuel tanks that are completely full at the time of turnover to the Government.

Design and construct a suitable generator pad with secondary containment for the generators. The generator pad shall have vibration isolators and the capability to dampen vibration to the surrounding ground through the use of foam plastic and sand. Install the generators with connections to the fuel supply tank(s), complete transmission/distribution system, transformers, panels, black start generator, and all other required appurtenances for a basic, fully operational system.

The power plant and fuel storage shall be enclosed within a compound with aggregate surfaced vehicle roadway and maneuver area. The compound shall be surrounded with a 3 m high chain link fence with Y-channel and triple

strand concertina wire on top, two (2) lockable double swing arm vehicle gates and one (1) lockable personnel gate. Construct the fencing and gates per the Fencing Details provided in the Appendix.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid under bid item, Site Power & Fuel Storage, of the Bid Schedule.

5.13 UNDERGROUND ELECTRICAL DISTRIBUTION SYSTEM

The Contractor shall provide and install all appropriate transformers, cable and any other equipment necessary for a fully functioning electrical distribution system. All electrical design and installation shall meet British Standard BS 7671 requirements. All wiring shall be run and pulled through conduits. Conductors and circuits shall be sized for the specific design loads. Utilization voltage shall be 220/380V, 50Hz.

Contractor shall design all interior electrical systems and any required exterior lighting as described in Section 01015, Technical Requirements. There shall be no lightning protection systems except as indicated on the standard building designs.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Underground Electrical Distribution System, in the Bid Schedule.

5.14 COMMUNICATION SYSTEM

The Contractor shall design, provide, and install the exterior and interior communications infrastructure. The exterior communications infrastructure shall be a looped system for perimeter security functions. The communications duct bank shall run to all buildings that require communications according to the standard drawings in the appendix. The interior communications infrastructure shall provide a pathway to all communications outlets and head-end equipment located in the buildings. Communications head-end equipment, cabling, RJ45 jacks, and faceplates shall be provided by others. The design and construction of the systems shall be in accordance with the references and the requirements contained herein and in Section 01015.

This portion of the project has been assigned "Priority 1"; the period of performance for the work in this paragraph shall be as stated for Priority 1 items in the Construction Priority Table in Section 1.1.

This portion of the project shall be paid for under bid item, Site Communication System, of the Proposal Schedule (Section 00010).

5.14.1 LOUD SPEAKER AND ALARM SYSTEM

As part of the Communications System bid item the Contractor shall install a Loud Speaker/Alarm System that can alert the entire compound via panic button from any tower or guard post station. The speaker and alarm system shall consist of exterior grade components that can withstand severe cold, and hot weather, rain, sleet, and dust storms. The System shall be completely understandable during severe weather conditions from any point within the compound. All cable and wires shall be installed in conduits.

-- END OF SECTION --

SECTION 01015

TECHNICAL REQUIREMENTS

1.0 GENERAL

1.1 COMPLIANCE

The Contractor's design and construction must comply with technical requirements contained herein. The senior designers of all engineering disciplines shall have a minimum of 10 years experience with the design and construction of the same magnitude and complexity as required in this project. The Contractor shall provide design and construction using the best blend of cost, construction efficiency, system durability, ease of maintenance and environmental compatibility.

1.2 MINIMUM & ALTERNATE REQUIREMENTS

The design and product requirements stated in these documents are minimum requirements. Exceeding the minimum requirements as improvements to the design stated herein is highly encouraged at no additional cost and as approved by the government. Any deviation from the technical requirements shall be approved by the Contracting Officer. Request for deviations shall be submitted for approval. The Contractor is encouraged to propose alternate design or products (equipment and material) that are more commonly used in the region; but these variations shall be equal in performance from a technical standpoint as well as more cost effective or allow for more timely completion. Variations shall furnish the same system safety, durability, ease of maintenance and environmental compatibility. The Contractor will be required to submit information as specified in Section 01335, paragraph Variations, for all proposed variations with which to make a comprehensive comparison of the proposed alternate. All variations of approved designs must be approved by the Contracting Officer.

1.3 ASBESTOS CONTAINING MATERIALS

Asbestos containing material (ACM) shall not be used in the design and construction of this project. If no other material is available which will perform the required function or where the use of other material would be cost prohibitive, a waiver for the use of asbestos containing materials must be obtained from the Contracting Officer.

1.4 SAFETY

1.4.1 UNEXPLODED ORDNANCE (UXO)

1.4.1.1 UXO/MINE DISCOVERY DURING PROJECT CONSTRUCTION

It is highly recommended that all construction ground guide/ground observation personnel maintain a minimum 16 m buffer zone from all heavy equipment during excavation activities. A daily check of the area for signs of recently emplaced UXO/IED's is also highly recommended, to include unusual disturbed soil areas or mounds of soil from the previous day. If during construction, the contractor becomes aware of or encounters UXO/Mine or potential UXO/Mine, the contractor shall immediately stop work at the site of encounter, clearly mark the area of UXO/Mine, move to a safe location, notify the COR, and mitigate any delays to scheduled or unscheduled contract work. Once the contractor has informed the COR, the contractor will await further direction. UXO/Mine disposal will not be the responsibility of the Contractor.

1.5 LIMITATION OF WORKING SPACE

The Contractor shall, except where required for service connections or other special reason(s), confine his operations strictly within the boundaries of the site. Workmen will not be permitted to trespass on adjoining property. Any operations or use of space outside the boundaries of the site shall be by arrangement with all interested parties. It must be emphasized that the Contractor must take all practical steps to prevent his workmen from entering adjoining property and in the event of trespass occurring the Contractor will be held entirely responsible.

Areas located immediately outside the construction area are known to contain mines and unexploded ordnance (UXO). Contractors assume all risks when venturing in or out of the designated work area.

1.6 TEMPORARY STRUCTURES

The Contractor shall erect suitable temporary fences, lighting, and necessary structures to safeguard the site, materials and plant against damage or theft and for the protection of the general public and shall adequately maintain the same throughout the course of the contract.

1.7 SUBCONTRACTORS

Compliance with the provisions of this section by subcontractors will be the responsibility of the contractor.

1.8 LIST OF CODES AND TECHNICAL CRITERIA:

The following codes and technical criteria and those referenced therein shall be required for this project. References within each reference below shall be required and adhered to. If there is conflict in the criteria the most stringent requirement shall be applied. This list is not exhaustive and is not necessarily complete.

AABC - Associated Air Balance Council (National Standards for total System Balance)

ACI 301M Specifications for Structural Concrete (latest edition), American Concrete Institute

ACI 318 Building Code Requirements for Structural Concrete (latest edition), American Concrete Institute

ACI 530/ASCE 5/TMS 402, Building Code Requirements for Masonry Structures (latest edition)

Air Force Manual 32-1071, Security Engineering, volumes 1-4, 1 May 1994

American Institute of Steel Construction (AISC), Specifications for Structural Steel Buildings (latest edition)

American Petroleum Institute (API) Codes

American Water Works Association, ANSI/AWWA C651-99 standard

ARI - Air Conditioning and Refrigeration Institute

ASCE 7, Minimum Design Loads for Buildings and Other Structures (latest edition)

ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning

Engineers Handbooks latest editions: Fundamentals; HVAC Systems and Equipment; HVAC Applications; Refrigeration.

ASHRAE Standard 55-latest edition, Thermal Environmental Conditions for Human Occupancy

ASHRAE Standard 62.1-latest edition, Ventilation for Acceptable Indoor Air Quality

ASHRAE Standard 62.2-latest edition, Ventilation and Acceptable Indoor Air Quality for Low-Rise Residential

ASHRAE Standard 90.1-latest edition, Energy Standard for Buildings Except Low-Rise Residential Buildings

ASHRAE Standard 90.2-latest edition with Supplement, Energy-Efficient Design of Low-Rise Residential Buildings

ASME - American Society for Mechanical Engineering

ASTM - American Society for Testing and Materials

ASTM-D-1586 Standard Test Method for Standard Penetration Test

ASTM-D-5299 Standard Guide for Decommissioning Ground Water Wells

AWS D1.1, Structural Welding Code – Steel (latest edition), American Welding Society

DCID 6/9 Physical Security Standards for Sensitive Compartmented Information Facilities

DCID 1/21, Manual for Physical Security Standards For Sensitive Compartmented Information Facilities (SCIF)

Design Standard per Memorandum for Record, Design Standards, DTD 16 August 2009 BT, Appendix B-1 and B-2

DoD Ammunition and Explosives Safety Standards

EIA ANSI/TIA/EIA-607: (1994) Commercial Building Grounding/Bonding Requirement Standard

Factory Mutual (FM) Approval Guide-Fire Protection (2002)

HESCO® Bastion Concentrator® Construct Guide for Engineers

IBC - International Building Codes, 2006 edition (and its referenced codes including those inset below)

IEEE C2, National Electrical Safety Code (NESC), latest edition

IFGC – International Fuel Gas Code, latest edition

IMC – International Mechanical Code, latest edition

IPC – International Plumbing Code, latest edition

Lighting Handbook, IESNA, latest edition

MIL-HDBK-1190, Facility Planning and Design Guide

National Association of Corrosions Engineers (NACE) Codes

Codes and Standards of the National Fire Protection Association (NFPA), as applicable and enacted in 2002 or later.

NFPA 1, General Fire Protection, latest edition

NFPA 10, Portable Fire Extinguishers, latest edition

NFPA 13, Fire Sprinkler Code, latest edition

NFPA 30, Flammable and Combustible Liquids Code, latest edition

NFPA 30A, Code for Motor Fuel Dispensing Facilities and Repair Garages, latest edition

NFPA 54, National Fuel Gas Code, latest edition

NFPA 58, Liquefied Petroleum Gas Code, latest edition

NFPA 70, National Electrical Code, 2005 edition

NFPA 72, National Fire Alarm Code, 2002 edition

NFPA 75, Standard for the Protection of Information Technology Equipment

NFPA 80, Fire Rated Doors and Windows, latest edition

NFPA 90A, Air Conditioning and Ventilating Systems, latest edition
 NFPA 96, Fire Protection for Commercial Kitchens, latest edition
 NFPA 101, Life Safety Code, latest edition
 NFPA 110, Standard for Emergency and Standby Power Systems, 2005 edition
 NFPA 221, Standard for Chimneys, Fireplaces, Vents, And Solid Fuel–Burning Appliances, latest edition
 NFPA 1141, Site Fire Protection, latest edition
 Plumbing and Drainage Institute (PDI-WH-201) water hammer arrestors
 SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Standards and Guides, latest editions
 International Mine Action Standards, latest edition; (see <http://www.mineactionstandards.org> for copy of standards)
 TM 5-785 Weather Data
 TM 5-802-1 Economic Studies
 TM 5-805-4 Noise and Vibration
 TM 5-811-1 Electrical Power Supply and Distribution
 UFC 1-200-01, Design: General Building Requirements
 UFC 1-300-07A Design Build Technical Requirements
 UFC 3-220-03fa Soils and Geology
 UFC 3-230-03a, Water Supply, 16 Jan 2004
 UFC 3-230-04a, Water Distribution, 16 Jan 2004
 UFC 3-230-06a, Subsurface Drainage, 16 Jan 2004
 UFC 3-230-07a, Water Supply: Sources and General Considerations, 16 Jan 2004
 UFC 3-230-08a, Water Supply: Water Treatment, 16 Jan 2004
 UFC 3-230-09a, Water Supply: Water Storage, 16 Jan 2004
 UFC 3-230-10a, Water Supply: Water Distribution, 16 Jan 2004
 UFC 3-230-13a, Water Supply: Pumping Stations, 16 Jan 2004
 UFC 3-230-17FA, Drainage in Areas Other than Airfields, 16 Jan 2004
 UFC 3-240-03N, Operation and Maintenance: Wastewater Treatment System Augmenting Handbook, 16 Jan 2004
 UFC 3-240-04a, Wastewater Collection, 16 Jan 2004
 UFC 3-240-09fa Domestic Wastewater Treatment 16 Jan 2004
 UFC 3-240-07fa Gravity Sewers 16 Jan 2004
 UFC 3-240-09fa Domestic Wastewater Treatment
 UFC 3-240-04A Wastewater Collection 16 Jan 2004
 UFC 3-260-01, Airfield and Heliport Planning and Design, 1 Nov 2001 with changes dated 19 May 2006
 UFC 3-260-02, Pavement Design for Airfields, 30 June 2001
 UFC 1-300-09N, Design Procedures
 UFC 3-310-01, Structural Load Data

UFC 3-310-02A, Structural Design Criteria for Buildings
UFC 3-400-01, Design: Energy Conservation, latest edition
UFC 3-410-01FA Heating, Ventilating and Air Conditioning, latest edition
UFC 3-410-02A, HVAC Control Systems, latest edition
UFC 3-410-04N, Industrial Ventilation, latest edition
UFC 3-420-01, Plumbing Systems Design, latest edition
UFC 3-420-02FA, Compressed Air, latest edition
UFC 3-430-01FA, Heating and Cooling Distribution Systems, latest edition
UFC 3-460-01, Petroleum Fuel Facilities, latest edition
UFC 3-501-03N, Electrical Engineering Preliminary Considerations, 16 Jan 2004
UFC 3-520-01, Interior Electrical Systems, 10 June 2002
UFC 3-520-05, Stationary Battery Areas, latest edition
UFC 3-530-01AN, Design: Interior and Exterior Lighting and Controls, 19 Aug 2005
UFC 3-535-01, Visual Air Navigation Facilities, 17 November 2005
UFC 3-540-04N Design: Diesel Electric Generating Plants, 16 Jan 2004
UFC 3-550-03FA Design: Electrical Power Supply and Distribution Systems, 1 Mar 2005
UFC 3-600-01, Design: Fire Protection Engineering for Facilities, 14 Jul 2009
UFC 4-010-01, Design: Minimum DoD Antiterrorism Standards for Buildings, 22 Jan 2007
UFC 4-020-03, Security Engineering: Fences, Gates, and Guard Facilities, 14 June 2007
UFC 4-020-03FA, Security Engineering: Final Design, 1 Mar 2005
UFC 4-020-04FA, Electronic Security Systems: Security Engineering, 1 Mar 2005
UFC 4-021-01, Design and O&M: Mass Notification Systems, draft 1 May 2006
UFC 4-022-01, Security Engineering: Entry Control Facilities/Access Control Points, 25 May 2005
UFC 4-229-01N, Design: General Maintenance Facilities, latest edition
UFC 4-722-01, Design: Dining Facilities, 27 January 2003

UL Standards (as applicable)

Underwriters' Laboratories (UL) Fire Protection Equipment Directory (2002)

UL 710, Exhaust Hood for Commercial Cooking Equipment, latest edition

UL 737, Fireplace Stoves, latest edition

UL 752, Bullet Resisting Equipment, 2000 or later

USCINCCENT OPORD 97-1

Overseas Environmental Baseline Guidance Document, Department of Defense, May 2007

The publications to be taken into consideration shall be those of the most recent editions.

Unified Facility Criteria (UFC) is available online at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

In addition, technical criteria provided in USACE-AED Design Requirements (most recent version) shall be required for use in design and construction specifications as indicated in the following documents. The following design criteria shall be used:

AED Design Requirements - Site Layout Guidance, latest version
AED Design Requirements - Well Pumps & Well Design, latest version
AED Design Requirements – Water Tank and Water Distribution Systems, latest version
AED Design Requirements - Booster Pumps, latest version
AED Design Requirements – Chlorinators, latest version
AED Design Requirements - Hydro-Pneumatic Tanks, latest version
AED Design Requirements - Jockey Pumps, latest version
AED Design Requirements - Water Tanks, latest version
AED Design Requirements – Hydrology, latest version
AED Design Requirements - Culvert and Causeway Design, latest version
AED Design Requirements - Sanitary Sewer and Septic Systems, latest version
AED Design Requirements - Grease Trap, latest version
AED Design Requirements - Oil-Water Separator, latest version
AED Design Requirements - Package Wastewater Treatment Plants and Lagoons, latest version
AED Design Requirements - Vertical Curves, latest version
AED Design Requirements – Horizontal Curves & Super elevation , latest version
AED Design Requirements – Geotechnical Investigations for USACE Projects, latest version
Standards other than those mentioned above may be accepted if the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall be prepared to submit proof of this if requested by the Contracting Officer.

1.9 AED DESIGN REQUIREMENTS DOCUMENTS

AED Design Requirements documents (latest version) listed above shall be adhered to in this contract. These documents are available from the COR. These documents shall be used as the basis for design and construction, and for selecting options within the United Facilities Guide Specifications (UFGS). It is the contractor's option to use specifications contained in the AED Design Requirements Documents, when provided, or to adapt the UFGS specifications to match the requirements provided in the AED Design Documents and specifications. Site or project specific data and requirements in the AED Design Requirements documents shall supersede UFGS language where there are differing criteria which must be evaluated and selected.

2.0 SITE DEVELOPMENT

2.1 ENVIRONMENTAL PROTECTION

2.1.1 APPLICABLE REGULATIONS

The Contractor shall comply with all Host Nation laws, rules, regulations or standards concerning environmental pollution control and abatement with regard to discharge of liquid waste into natural streams or manmade channels. The Contractor shall review host nation and U.S. Government environmental regulations with the Contracting Officer prior to design and discharge of any liquid wastes into natural streams or manmade channels.

2.1.2 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed non-compliance with the foregoing provisions. The Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No extension of time or damages will be awarded to the Contractor unless it was later determined that the Contractor was in compliance.

2.1.3 SPILLAGES

Measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides and insecticides, and construction materials from polluting the construction site and surrounding area.

2.1.4 DISPOSAL

Disposal of any materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., shall be taken to a dumpsite off site and be subject to the approval of the Contracting Officer. Burning at the project site for the disposal of refuse and debris will not be permitted.

2.2 CIVIL SITE DEVELOPMENT

2.2.1 EXISTING CONDITIONS MAP AND SITE PLAN

The Contractor shall prepare an Existing Conditions Map of the property including a Boundary Survey. The survey shall show the closure of the property boundary consisting of identifying all property corners, establishing horizontal and vertical control, listing all bearing and distances of property lines from all property corners, and tie-ins (showing bearing and distance) from at least two (2) major offsite man-made or natural features. This survey shall meet the requirements of World Geodetic System 1984 (WGS 84 UTM Zone 41N in decimal degrees). The Existing Conditions Map shall include topographic information with existing contour lines and spot elevations of relevant topographic features, and show the locations of all on-site and nearby offsite existing features including but not limited to buildings, structures, major trees, road pavements and right of ways, names of roads, widths of roads, easements, right of way, setbacks, parking, paved areas, storage containers, stoops, sidewalks, walkways, walls, fences and gates, Hesco barriers, and existing underground and aboveground utilities, dry creek beds, drainage channels, etc. and hydrological, geological, and vegetative or other physical conditions that could impact design. If there are areas where offsite surface water runoff has the potential to affect this project, topographic information of these areas will be required to be provided.

Based on the Boundary Survey a separate Site Plan shall be prepared showing the property boundary, and all proposed surface features including but not limited to buildings, roads, setbacks, parking and paving areas, storage containers, stoops, sidewalks and walkways, above ground utilities, bunker locations. The contractor shall identify and show perimeter walls, fences and gates, guard towers and entry control point structures. Also shown on the Site Plan shall be pertinent existing features (on-site and off-site) that will have an influence or impact on the development of the site. The Contractor shall locate the facilities in agreement with the associated drawings included and any requirements in Section 01010. All site features shall be clearly defined and dimensioned on the Site Plan. Buildings shall be located to provide access for emergency vehicles and fire fighting. Roads and parking areas shall be designed for turning radius of the largest vehicle entering the compound. The site plan shall show geometric design of the site, including applicable dimensions of all exterior facilities, mechanical equipment, pavements, utilities, etc. Required facilities are described in the following sections of this specification. All roads and areas where tractor-trailer vehicles will travel shall be designed for the worst case turning radius. All site plans and master plans shall be drawn in the following projection and datum for incorporation into the USACE GIS system:

WGS 1984 UTM Zone 41 N

2.2.2 DEMOLITION

Demolition shall include removal of all structures, foundations, pavements, and utilities, and clearing and grubbing as described in Section 01010.

Holes and depressions shall be properly backfilled as necessary with fill materials composed of satisfactory soils or aggregates defined in ASTM D 2487 as GW, GP, GM, SP, SM, and SW. Minimum soil compaction shall be 95 percent of maximum density as defined in ASTM D 1557.

2.2.3 SITE GRADING & DRAINAGE

The Contractor shall provide all necessary site grading to insure adequate drainage so that no areas will be flooded due to a rainfall of a 20-year frequency. Drainage of the area should be compatible with the existing terrain. Building floor elevation shall be a minimum 150mm above grade and slope away from the building on all sides at a minimum of 5% for 3 m. All other grading on site shall be a minimum of 1% to ensure proper drainage.

Proper drainage calculations shall be conducted in order to size drainage structures and channels properly.

Rainfall data shall be based on data obtained from meteorological records collected in Afghanistan. National agencies may be consulted for data. In the absence of site specific data, intensity-duration-frequency curves contained in the AED Design Requirements – Hydrology-most recent version shall be used by extrapolating the rainfall intensity information from the stations in closest proximity to the project.

Under no circumstances will relationships developed by extrapolation of hydrological data from foreign countries be used for hydrologic studies.

2.3 ROADS, PARKING, MANEUVER, AND STORAGE AREAS, AND FOOT PATHS

Location, type, and width of roads, parking, maneuver, and storage areas required are stated in Section 01010. Roads, parking, maneuver, and storage areas shall be geometrically designed, graded for proper drainage, and provided with necessary drainage structures. Contractor shall notify the Contracting Officer immediately if initial site survey determines that area hydrology requires major drainage structures or bridges. Also, the Contracting Officer shall be immediately notified if the required lengths of road, parking, maneuver, and storage area preexisting conditions are determined to be substantially or materially different than the above-described conditions/estimates.

All intersecting roads, parking, maneuver areas, storage areas, and foot paths, driveways, and culvert crossings are required to end with a smooth transition with new road profiles.

All roads and areas to have asphalt paving are indicated in Section 01010. All roads and areas indicated in Section 01010 to be asphalt paved shall be surfaced with minimum 50 mm thick hot mix asphalt concrete compacted at 98% maximum density placed above a minimum 200 mm thick base course minimum compacted at 100% maximum proctor density placed above 150 mm thick of scarified sub-grade compacted to 95% maximum density, unless otherwise noted.

All roads and areas to have aggregate surface are indicated in Section 01010. All roads and areas indicated in Section 01010 to have aggregate surface shall consist of minimum 100 mm thick compacted aggregate base course compacted to 100% maximum density placed above minimum 150 mm thick of scarified sub-grade compacted to 95% maximum density, unless otherwise noted.

For all asphalt and aggregate roads, the Contractor shall provide 1.0 m wide, aggregate base shoulder compacted to 100% maximum density that is 150 mm thick at 2.0% slope on both sides of the roadway. Provide 1.0 m wide shoulder around all parking areas, storage areas, convoy assembly area, DFAC and motor pools consisting of 150 mm thick aggregate base course material at 2.0% slope. The centerline of all roads shall be sloped a minimum of 1% and a maximum of 8%.

The roads shall be capable of withstanding traffic of 18,000-kg vehicles. All roads shall be designed geometrically with applicable sections of UFC 3-250-18FA and UFC 3-250-01FA to accommodate WB-50 five axle vehicles with a maximum speed of 20 kilometers per hour. Pavement surfaces shall be designed for a design life of 25 years, Road Class F, Category IV.

The above pavement structure dictated above are minimum requirements. Design of roads, parking, maneuver, and storage areas shall be conducted based on geotechnical data. The geotechnical data shall be used to calculate the pavement structure using the minimum pavement structure as dictated above as a reference. Reference Section "Geotechnical" below.

Aggregate Base Course (ABC) material must be well graded, durable, uniformly moistened, and mechanically stabilized by compaction. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure in ASTM D 1557.

The Contractor shall design and construct 1.5 m wide concrete foot paths. Foot Paths shall have a compacted base, be appropriately graded for drainage, and covered with a concrete surface. The concrete footpaths shall be required to connect all buildings, facilities, and features such as offices, classrooms, billeting, etc. Footpaths shall be shown on the Site Plan and a detail of the foot paths shall be provided in the design drawings.

The Contractor shall design and construct firelanes on a minimum of three (3) sides of all buildings. Fire lanes shall be a minimum of three (3) meters wide and paved with a minimum of 150 mm of concrete paving. Footpaths may be used as firelanes if the footpath is a minimum of 3.0 m wide. All footpaths that are used as firelanes shall be concrete paved."

2.3.1 FORCE PROTECTION DESIGN

The Contractor shall design and construct force protection measures. The Force Protection design shall incorporate minimum setbacks for new facilities to maximum extent possible as permitted by size of the site and the requirements of the user. Force protection design shall be in accordance with Joint Security Directorate Antiterrorism/Force Protection Guide, March 2002. Force Protection design shall also meet the requirements of UFC 4-010-01, Design: Minimum DoD Antiterrorism Standards for Buildings, 8 Oct 2003 and UFC 4-010-02, DoD Minimum Antiterrorism Standoff Distances for Buildings, 8 Oct 2003 and Joint Security Directorate Antiterrorism/Force Protection Guide, March 2002.

2.3.1.1 PERIMETER WALL

The Perimeter Wall shall be designed and constructed around the perimeter of the site according to the standard design in the appendix.

The ground grade shall slope away from the wall for at least 5 m and shall be kept a minimum of 3.0 m below the top of wall for a minimum distance of 10 m. The wall shall be designed to prevent visual access to the inside of compound by all pedestrian and vehicular traffic outside the compound which may require the wall to be built at a higher level in some locations. Any penetrations through the Perimeter Security Wall shall only be for site drainage purposes and shall have force protection such as a welded bar grill, welded grating, or other pre-engineered barrier. Details of any penetrations shall be produced by the contractor and provided in the design drawings.

2.3.1.2 PERIMETER WALL ACCESS GATES

2.3.1.2.1 SLIDING GATES

Gates shall be K4 sliding type. Gate shall be 3 m high with 0.5 m of high tension razor wire mounted on top. Gate shall be constructed of 100 mm x 100 mm x 5 mm square steel tubing, faced with 5mm steel plate. The design and construction of the gates shall insure that it is dimensionally stable, square, true and planar. Sliding Gate shall not rack or deflect when open, closed, or in motion. Gate tracks shall be anchor mounted to galvanized steel stanchions. Provide a locking mechanism that holds the gate closed. Provide reinforced grade beam across gateway flush with pavement to lock gate with flush mounted

vertical sliding bolts, bolts shall be 50 mm diameter solid steel. The sliding gate will also have a built-in personnel gate with its own locking mechanism.

2.3.1.3 OUTRIGGERS

Outrigger supporting arms shall be “Y” shaped with post securely embedded into the top of the wall. Posts shall conform to ASTM F 1083, Pipe, Steel, Hot Dipped Zinc Coated (Galvanized) Welded.

2.3.1.4 REINFORCED BARBED TAPE

Reinforced barbed tape shall be 600 mm diameter concertina style coil consisting of 31 loops. Each loop shall consist of 19 barb clusters per loop. Adjacent coils loops shall be alternately clipped together at three points about the circumference to produce the concertina effect upon deployment. Spacing between attachments points when deployed shall be 400 mm. The reinforced barbed tape shall be fabricated from 430 series stainless steel with hardness range of Rockwell (30N) 37-45 conforming to the requirements of ASTM A 176. Each barb shall be a minimum of 30.5 mm in length, in groups of 4, spaced on 102 mm centers. The stainless steel core wire shall have a 2.5 mm (0.098 inch) diameter with a minimum tensile strength of 895 MPa. Sixteen gauge stainless steel twistable wire ties shall be used for attaching the barbed tape to the barbed wire. The reinforced barbed tape shall be equivalent to NSN: 5660-01-457-9852.

2.3.1.5 CHAIN-LINK FENCE AND GATES

Provide chain-link fences and gates where required. Chain link fence and gate fabric shall be No. 9 gage wires woven into a 50 mm diamond mesh. Fabric shall be coated with 366 grams per square meter zinc galvanizing. Posts shall be ASTM F 1083 Pipe, Steel, Hot Dipped Zinc Coated (Galvanized) Welded or equal. Top of fence and gates shall be provided with outriggers and reinforced barbed tape as indicated above. Post sizes shall be as shown on drawings.

The gates shall be swing type. Hinged gates shall be a pair of 3.65 m wide x 2.4 m high leafs, constructed of a steel tube frame and steel tube intermediate posts and rails. The design of the gates shall insure that it is dimensionally stable, square, true and planar. Gate leafs shall not rack or deflect when installed on its hinges. Gates shall have a sufficient number of hinges; anchor mounted to the exterior masonry walls, to support each gate leaf. Provide a locking mechanism that holds the gates together when in the closed position as well as a drop bolt that engages a steel sleeve embedded in the pavement.

2.3.1.6 ENTRY CONTROL POINT (ECP)

ECP facilities shall be laid out and constructed by the Contractor to facilitate secure entrance of authorized vehicles into the compound. A guard shack shall be provided inside the compound as part of the Primary ECP and Secondary ECP. Entrance to the ECPs shall be paved and the primary ECP and range ECP shall have a single-leaf manually operated sliding steel gate. The gate shall be considered the Active Vehicular Barrier (AVB). Drop arm and guard shack shall be provided and located at a distance of one and a half vehicles away from the entrance to serve as a checkpoint. Jersey Barriers or other approved alternatives shall be used to design and construct a Passive Vehicular Barrier (PVB) beyond and away from the checkpoint to significantly slow down approaching vehicles. The PVB shall be laid out to force approaching vehicles into a snake-like manoeuvre while approaching the checkpoint and to significantly slow them down.

Provide rejection lanes where applicable after vehicle inspection and before entrance to the compound to allow rejected vehicles to circle back to the entrance road without interruption of the queue.

2.3.1.6.1 VEHICLE BARRIERS

2.3.1.6.1.1 ACTIVE BARRIERS - DROP ARM GATES

The height of the beam shall be a minimum of 762 mm above finished grade. The crash beam must be

capable of blocking a minimum road width of 4.0 m. The crash beam shall be manually raised and lowered with less than 133 Newtons of force. The end of the crash beam should include a locking pin with padlock acceptance for securing the beam when it is in the down position capable of stopping large (4500 kg) trucks, in addition to heavy duty steel gates into the compound.

The gate shall be designed to accommodate a vehicle that is 6 m high (including gunners nest). Show a sketch in the design drawings of how the arm will clear the vehicle and gunners nest.

2.3.1.6.1.2 PASSIVE BARRIERS – JERSEY BARRIER

Barriers shall be concrete blocks constructed per the standard design in the Appendix.

2.4 CIVIL UTILITIES

2.4.1 WATER

2.4.1.1 GENERAL

The Contractor shall provide water distribution mains, branches, service connections to include all pipe, valves, bends, thrust blocking, fittings and appurtenances. Exterior water line construction shall include service to all buildings as described in the Scope of Work Section 01010. The water system shall be designed to operate between 345-414 kPa. Minimum pressures of 207 kPa will be allowed at peak domestic flow conditions. The required average daily flow (ADF) shall be the average daily demand (ADD) per person - derived from 190 liters per capita per day (lpcd) – times a capacity factor (CF) of 1.5, times the effective population.

In the event potable or non-potable use water is required prior to completion of the water facilities infrastructure the Contractor may be issued a Request for Proposal to provide non-potable (tank truck) and potable (bottled or other reliable source) consumption.

Provide a minimum of one (1) outside water hydrant (hose spigot) for all buildings with water service. Every hose spigot shall have a lockable valve on its water line located inside an adjacent building or in a valve box. All buildings with water supply shall have a water meter installed in a locked cabinet area inside the building.

Features of the water system shall be sized to provide flow or storage capacity as follows:

- Water Well Pump Capacity - Capacity and total dynamic head (TDH) shall be based on an adjusted ADF (ADD, times the population, times the capacity factor) over a 16 hour period).
- Water Tanks - Capacity shall be based on $ADF (ADD \times c \times CF \times 3)$, or as otherwise stated in Section 01010.
- Booster Pumps – The capacity shall be based on the installation wide, total fixture unit flow or 2 times the average daily flow (16 hour basis), whichever is greater. Three identical pumps shall be provided which are all sized to deliver 50% of the calculated capacity. Pumps shall automatically alternate to distribute wear and shall automatically turn on and off based on demand and system pressures. The total dynamic head (TDH) of the booster pumps shall be calculated to maintain a minimum, residual system pressure of 40 psi at the calculated capacity unless stated otherwise in the contract documents. Either a bladder style expansion tank or a hydro-pneumatic tank shall be supplied when booster pumps are used in the water system.
- Hydro pneumatic tanks – Volume and pressure regulation to maintain a pressure range provided in the technical requirements based on a rate equal to the $ADF (ADD \times c \times CF)$.
- Water Mains – Diameter based on the installation fixture unit flow or two times the $ADF (ADD \times c \times CF)$ and velocity requirements per this guide unless a minimum diameter is specified which is adequate to

provide flow and meet the specified maximum velocity. The flow through the system shall be distributed on the basis of fixture unit flow in each the buildings serviced or per contract

- Water Service Lines - Diameter based on fixture units of the building serviced or per contract

2.4.1.2 WATER WELLS

The Contractor shall construct water well(s) inside the compound, to provide sufficient supply for the facilities. The water well pump capacity and Total Dynamic Head (TDH) shall be based on an adjusted ADF (ADD, times the population, times the capacity factor) over a 16 hour period. The new well capacity shall have an allowable safe yield determined by a well pump test as described in the USACE-AED Design Requirements - Well Pumps & Well Design/Specifications, latest version. The new well site shall be at a location approved by the Government. The new well site shall be no closer than 60 meters from any existing wells. Well construction shall be in accordance with the USACE-AED Well Design Guide and Water Well Guide Specification. If installation of one or more wells with sufficient yield is not possible within the compound, the Contractor shall immediately notify the COR for resolution.

After de-mining, if applicable, but prior to the construction of any structures, the Contractor shall submit a well test plan, drill and test the water well, conduct well design activities, conduct a chemical analysis of the water, and submit all required information to AES for review prior to installing any permanent well features. A plan for decommissioning dry wells shall be included with the well drilling plan.

Well construction shall be in accordance with AED Design Requirements - Well Pumps & Well Design/Specifications, latest version - which includes, but is not limited to, requirements for well screen, casing, gravel pack, well pump, disinfection, water meters and testing requirements. All design requirements, material specifications, and testing contained in this document shall be used and submittals shall be made promptly in accordance with Section 01335. Failure to follow the construction and submittal procedures outlined may, at AED's discretion, result in rejection of the well and, the Contractor having to remove the well casing and screen, re-drill the well and reinstall the proper features per the approved design.

Well Depth. The Contractor shall drill and install wells using the quantity, location depth specified in Section 01010. The depth of the permanent well shall take into consideration the drawdown depth, screen depth and pump submergence. If water cannot be found the Contractor shall immediately notify the Contracting Officer's Representative (COR).

Casing. Selection of the casing diameter, material and depth shall be per the AED Design Requirements document. In unconsolidated material, casing shall extend to the top of the well screen. In rock formations (drilled wells) the hole may be left open (i.e., well screen not required) with casing extended 3 m into the rock formation. All wells will be cased 610 mm above grade (i.e., base of pit, ground surface, etc.) and be fitted with a lockable cap with air gap (vacuum relief during pumping). Each section of casing will be joined with standard couplings and full-threaded joints, or by proper welding, so that all joints are sound and watertight. Well casing alignment shall not interfere with the proper installation and operation of the pump. The bottom of the casing shall be fitted with a metal or PVC well screen that will permit maximum transmission of water without clogging. The minimum length of screen shall be at least 3 m.

Sealing: The drilling process shall create a hole (borehole) larger than the casing (minimum of 2 inches). The annular space between the casing and the borehole will be filled with gravel, overburden, or concrete as follows:

- a. The annular space between the well screen and borehole shall be filled with material that will form a filter to minimize production of fines and not clog the slots in the screen (e.g., washed, well-graded silica sand).
- b. The annular space above the filter pack up to the base of the grout seal may be backfilled with overburden or other clean earth material.
- c. The upper 3 m of the well bore shall be sealed with neat cement grout. The grout shall be placed in one continuous mass and shall be impermeable.

- d. Crushed stone for well sealing shall consist of crushed stone containing angular shapes and surfaces with no rounded surfaces with the following gradation:
- e.

Sieve Size	% Total Wt. Passing
12.5 mm	100
4.75 mm	75 ± 13
1.18 mm	25 ± 15
75 µm	8 ± 4
- f. All aggregate shall contain less than 5 percent of shale, clay lumps, coal, lignite, soft or unfragmented stone, or other deleterious materials.

Well screen, casing, gravel pack, well pump, disinfection, and testing requirements for well construction shall meet the specifications and design requirements in AED *Design Requirements - Well Pumps & Well Design/Specifications*, June 2009, or most recent version.

Screen. The casing will be fitted with a well screen that will permit maximum transmission of water without clogging. The material of construction, opening requirements, minimum lengths and placement shall be per the AED Design Requirements document. **The Contractor shall only screen the deepest targeted aquifer, screening throughout the depth of the well is not permitted.**

Source Protection: Surface drainage within 30 m of the wellhead shall ensure no ponding, flooding, or collection of runoff adjacent to the well. This can be accomplished through surface grading or use of gravel drains to modify site drainage in the vicinity of the well. The Contractor shall identify all sources of contamination and ensure the proposed well site meets minimum standoff distances as indicated below:

- a. Sewage storage areas (outhouses, tanks, individual sewage pits, lagoons, and WWTP) – 30 m
- b. Fuel storage, engine maintenance/repair – 30 m

Expansion Tank – Provide bladder style expansion tank for the well pump to minimize pressure surges and water hammer effects.

2.4.1.3 WATER QUALITY CONTROL AND TESTING

The Contractor shall perform water quality sampling and testing at the source. The Contractor shall utilize well-qualified and equipped testing capability in the project site area, if available. If professional testing services are not available in the area, the Contractor will submit an alternative practical testing source for approval. Raw water quality criteria requirements for laboratory testing shall be addressed in accordance with USACE-AED Well Pumps & Well Design Guide with Attachment A – Guide Specifications for Drinking Water Wells, latest version for requirements for laboratory testing.

2.4.1.4 WELL WATER PUMPS

An electric submersible well pump will fill the above ground water tank. The well pump shall be installed inside the casing set no less than 3 m above the screen or in casing between screened intervals a minimum of 3 m above and below the screens. Pumps shall not be located in a screened interval. Control of the pump shall be by means of a Hand-Off-Auto (HOA) switch. In the “Auto” position, the pump shall be started and stopped automatically by water levels in the water storage tank. Pump shall start at low level and shall stop at high level. Level controls shall be adjustable. Manual start shall be the Hand position.

2.4.1.5 RAW WATER DISINFECTION

Contractor shall perform disinfection of the well water in accordance with AED Design Requirements - Well Pumps & Well Design/Specifications, latest version. Bacteriological samples shall be collected and examined in accordance with Standard Methods for the Examination of Water and Wastewater by a qualified lab as approved by the Contracting Officer.

2.4.1.6 SERVICE BOOSTER PUMPS

Contractor shall provide a booster pump station to provide water to the water distribution system. The system shall be equipped with hydropneumatic surge tank(s). Service booster pumps shall be end suction or split case double suction horizontal split case (frame mounted) centrifugal pumps arranged in parallel for pumping water storage into the water distribution system. The pumps and controls shall be designed to supply and maintain acceptable system pressure to the water distribution system. The suction side of the service booster pumps shall have an eccentric reducer and gate valve installed. The discharge side shall have a gate valve, check valve between the pump and the gate valve and concentric reducer, pressure gage and air relief valve.

Three identical pumps shall be provided. Two pumps shall alternate to distribute wear (with one as a back-up) and shall automatically turn on and off based on demand. The booster pump system shall be enclosed in a CMU booster pump building per the drawings titled "Booster Pump Building" in the Appendix.

2.4.1.6.1 HYDRO-PNEUMATIC SURGE TANK(S)

The Contractor shall provide horizontally mounted and insulated above ground surge hydro-pneumatic tank(s) containing water and compressed air located adjacent to the water pumps to maintain pressure during surges. A compressor is required to charge the tank with air, or a pre-charged bladder type tank may be used. At low level the water remaining in the tank(s) shall be at least ten percent of the capacity of the tank. The tank(s) size shall be determined such that the pump cycles not less than 4 times per hour or more than 10 times per hour.

2.4.1.7 WATER STORAGE TANK

Contractor shall provide a steel ground storage tank(s) (GST) to be located on the ground surface and sized per Section 01010. The storage facility shall be located above drainage areas and locations subject to flooding as approved by the Contracting Officer. The storage facility shall be located on the higher elevations of the site to promote gravity flow and reduce pumping requirements. Overflow and air vents shall be screened so that birds, rodents and debris cannot enter the reservoir. The tank shall meet all applicable codes for potable water storage. The interior coatings for the tank shall meet NSF/ANSI 61 requirements.

2.4.1.8 DISINFECTION & CHLORINATION SYSTEM

The Contractor shall test water for World Health Organization (WHO) potable drinking water standards and if treatment is required, the Contractor shall immediately notify the Contracting Officer. Regardless of water quality the Contractor shall provide and install a water disinfection system. The chlorination system shall be enclosed in the booster pump building.

Use hypochlorite compounds for disinfection. A hypo-chlorinator shall be used to feed a sodium hypochlorite solution of 5-15% available chlorine into the system. Hypochlorite compound may be a liquid or solid form. The hypo chlorination system shall consist of a chemical solution tank for hypochlorite, diaphragm-type pump, power supply, water pump, pressure switch and storage tank (optional hydro-pneumatic/storage). The pump shall feed a hypochlorite solution in proportion to the water demand. The hypo-chlorinator shall have a pumping rate, liters per day (lpd) adequate to deliver 5 percent (%) available hypochlorite solution adjustable to the quantity of water being produced from the source. Dosage rate will vary somewhat depending on actual pump production rate and available residual chlorine in the system. Contractor shall determine the required dosage rate milligrams per liter (mg/l) to maintain the required chlorine residual (usually 0.2-0.4mg/l) in the distribution system. Chlorine solution tank shall be large enough to hold a three day supply of hypochlorite solution. A fresh solution shall be prepared every two or three days because the solution may lose its strength over time and this will affect the actual chlorine feed rate. The hypochlorite shall be stored in a cool dry place. Sodium hypochlorite can lose from two to four percent of its available chlorine content per month at room temperature. Contractor shall verify required minimum residual chlorine in accordance with local requirements verified and approved by the Contracting Officer. The chlorination system shall have the capability for manually adjusting the dosage rate and be installed in such a manner that the system can be easily disconnected and bypassed in the event of health safety or routine maintenance and repair. Disinfection of water mains shall be in accordance with AWWA standard C651-86 and disinfection of storage facilities in accordance with AWWA standard C652-86.

2.4.1.9 CHLORINE SHELTER

Chlorination equipment shall be installed inside the well houses(s) provided space is available. In the event space is not available, Contractor shall furnish a shelter as per chlorine manufacturer's installation requirements. The Contractor shall provide manufacturers catalog information and shop drawing to the Contracting Officer for approval.

2.4.2 WATER DISTRIBUTION SYSTEM

2.4.2.1 GENERAL

The Contractor shall provide a water distribution system. The distribution network shall be laid out in a combination grid and looped pattern with dead ends not exceeding 30 m. Use similar piping materials for all buildings and pipe runs in the distribution system for efficiency of future maintenance activities. Dead end sections shall not be less than 150 mm diameter and shall either have blow off valves or fire hydrants (flushing valves) installed for periodic flushing of the line. Any pipe with a fire hydrant on the line shall be at least 150 mm in diameter. Water supply distribution shall connect to a building service at a point approximately 1.5 m outside the building or structure to which the service is required. All piping and joints shall be capable of at least 1.03 MPa leakage testing and 1.38 MPa hydrostatic pressure test, unless otherwise specified. Pipe diameters shall be adequate to carry the maximum flow of water at velocities less than 1.5m/sec. Piping segments where velocities less than 0.15 m/sec are anticipated shall be noted and brought to the attention of AES. The operating pressure range shall be between 345 kPa to 414 kPa at all points of the distribution system. If pressures greater than 690 kPa cannot be avoided, pressure-reducing valves shall be used. A system pressure of 207 kPa (30 psi) is acceptable at extreme peak flow conditions. A system pressure below 207 kPa shall be considered a deviation in the technical requirements requiring Contracting Officer approval.

Adequate cover must be provided for frost protection. A minimum cover of 800 mm is required to protect the water distribution system against freezing. Water lines less than 1.25 m deep under road crossings shall have a reinforced concrete cover of at least 150 mm thickness around the pipe extending out to 1 m from each road edge.

2.4.2.2 PIPE

The Contractor shall provide Ductile Iron or PVC pipe of adequate strength, durability and be corrosion resistant with no adverse effect on water quality.

2.4.2.2.1 WATER MAINS AND BRANCHES

Water main diameter shall be based on the installation fixture unit flow or two times the ADF ($ADD \times c \times CF$) and velocity requirements per this guide unless a minimum diameter is specified which is adequate to provide flow and meet the specified maximum velocity. Pipe material for water mains and branches shall be PVC or Ductile Iron (DI). The exterior surface of the pipe must be corrosion resistant. Distribution lines shall not be less than 100mm in diameter. Pipe diameters shall be 100mm and larger. Pipe diameters shall be selected to meet the previously specified flow, velocity, and pressure conditions. If Ductile Iron (DI) pipe is installed underground the pipe shall be encased with polyethylene in accordance with AWWA C105. Ductile iron pipe shall conform to AWWA C104. DI fittings shall be suitable for 1.03 MPa pressure unless otherwise specified. Fittings for mechanical joint pipe shall conform to AWWA C110. Fittings for use with push-on joint pipe shall conform to AWWA C110 and C111. DI fittings shall be cement mortar lined (standard thickness) in accordance with C104. All pipes and joints shall be capable of at least 1.03 MPa leakage test and 1.38 MPa hydrostatic pressure test unless otherwise specified herein. Polyvinyl Chloride (PVC) pipe shall conform to ASTM D 1785. Plastic pipe coupling and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. PVC screw joint shall be in accordance with ASTM D 1785, Schedules 40, 80 and 120. PVCu pipe couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. Pipe less than 80mm (3 inch), screw joint, shall conform to dimensional requirements of ASTM D schedule 80. Elastomeric gasket-joint, shall conform to dimensional requirements of ASTM D 1785 Schedule 40, PVCu (or uPVC)

pipe and fittings shall have SDR that provide equal or superior strength properties to ASTM 1785 SCH 40 or SCH 80 pipe and fittings.

2.4.2.2.2 WATER SERVICE

Water service line diameter based on fixture units of the building serviced or per contract. Building service lines will be sized according to the following guidance. Water service connections from the mains to the buildings shall vary from 19mm, 25mm, 38mm, 75mm, to 100mm as calculated, depending on the maximum flow velocity and minimum pressure requirements as determined by hydraulic analysis of fixture flows. Pipe service connections from the distribution main to the building shall be either Polyvinyl Chloride (PVC) plastic Schedule 80 ASTM D 1785 or copper tubing conforming to ASTM B 88M, Type K, annealed. PVC pipe couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. Contractor shall not use HDPE for any of the water pipes.

2.4.2.3 HYDROSTATIC, LEAKAGE AND DISINFECTION TESTS

The Contracting Officer will be notified not less than 48 hours in advance of any water piping test and will be given full access for monitoring testing procedures and results. Where any section of water line is provided with concrete thrust blocking for fittings or hydrants, tests shall not be made until at least 5 days after installation of concrete thrust blocking, unless otherwise approved. Pressure and leakage testing shall be as specified in AED Design Requirements – Water Tank and Water Distribution Systems, latest version.

2.4.2.4 PRESSURE TEST

After the pipe is laid, the joints completed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants and valves shall be carefully examined during the partially opened trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered following this pressure test shall be removed and replaced and retested until the test results are satisfactory.

2.4.2.5 LEAKAGE TEST

Leakage tests shall be conducted after all pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and, during the test, water lines shall be subjected to not less than 1.01 MPa. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure to within 34.5 kPa of the specified leakage test pressure after the pipe has been filled with water and all air expelled. Pipe installation will not be accepted if leakage exceeds the allowable leakage, as determined by the following formula:

$$L = 0.0001351ND (P \text{ raised to } 0.5 \text{ power}), \text{ where:}$$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the government.

2.4.2.6 BACTERIOLOGICAL DISINFECTION

2.4.2.6.1 DISINFECTION PROCEDURE

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651. After pressure tests have been completed, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. Flushing will be performed in a manner and sequence that will prevent recontamination of pipe that has previously been disinfected. The chlorinating material shall be liquid chlorine, calcium hypochlorite, or sodium hypochlorite. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipelines shall be chlorinated using only the above-specified chlorinating material in solution. The agent shall not be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. Valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm.

2.4.2.6.2 SAMPLING

For each building connected to the water system, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with approved methods. The commercial laboratory shall be verified to be qualified by the appropriate authority for examination of potable water. Contractor shall submit a water sampling protocol for approval. This shall include at a minimum the name of the laboratory, parameters to be tested, the Company conducting the sampling, and the sample locations.

2.4.2.6.3 ACCEPTANCE REQUIREMENTS

The disinfection shall be repeated until tests indicate the absence of bacteria for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained. All retests shall be conducted at the Contractor's expense.

2.4.2.6.4 TIME FOR MAKING TESTS

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipeline jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill.

2.4.2.6.5 CONCURRENT TESTS

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be recorded for submission and approval. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government. Pressure and leakage testing may be conducted concurrently. Hydrostatic tests and disinfection may be conducted concurrently using water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be re-accomplished.

2.4.2.6.6 VALVES

Valves (Gate valves w/box) shall be placed at all pipe network tees and cross intersections, and the number of valves shall be one less than the number of lines leading into and away from the intersection. For isolation purposes valves shall be spaced not to exceed 3600 mm (12 feet). Gate valves shall be in

accordance with AWWA C 500 and/or C509. Butterfly valves (rubber seated) shall be in accordance with C504 etal. The valves and valve boxes shall be constructed to allow a normal valve key to be readily used to open or close the valve. Provide traffic-rated valve boxes. Provide concrete pad, 1 m square, for all valve boxes.

2.4.2.6.7 VACUUM AND AIR RELEASE VALVES

Air release valves are required to evacuate air from the main high points in the line when it is filled with water, and to allow the discharge of air accumulated under pressure. Vacuum relief valves are needed to permit air to enter a line when it is being emptied of water or subjected to vacuum. Contractor shall submit manufacturer's data for properly sized combination air and vacuum release valves and determine their locations on the distribution system subject to review and approval of the Contracting Officer.

2.4.2.6.7.1 BLOW-OFF VALVES

The Contractor shall provide 40-50 mm blow-off valves at ends of dead end mains. Valves should be installed at low points in the mains where the flushing water can be readily discharged to natural or manmade drainage ditches, swales or other.

2.4.2.7 THRUST BLOCKING

Contractor shall provide concrete thrust blocking at any point where the layout of the system changes the direction of the flow, increases the velocity, or decreases or stops the flow. At these points, the pipes and fittings must be anchored and kept from moving or pulling apart by the use of thrust blocks installed against undisturbed earth.

2.4.3 SANITARY SEWER

2.4.3.1 GENERAL

The Contractor shall obtain topographic information or other maps that show vegetation, drainage channels and other land surface features such as underground utilities and related structures that may influence the design and layout of the collection system. Sanitary sewers less than 1.25 meters under road crossings shall have reinforced concrete cover at least 150 mm thick around the pipe. Concrete cover will extend out to at least 1 m from each road edge.

Exterior sanitary sewer line construction shall include service to all buildings as described in the Scope of Work Section 01010. Contractor shall design sanitary sewer collection system using approved field survey data and finished floor elevations. Depending upon the topography and building location, the most practical location of sanitary sewer lines is along one side of the street. In other cases they may be located behind buildings midway between streets. Main collection sewers will follow the most feasible route to the point of discharge. The sewer collection system shall be designed to accommodate the initial occupancy and a reasonable expansion capability. Sewer collection capacity shall be based on the two times the average daily wastewater flow unless minimum diameter specified is adequate to provide flow and required maximum velocity; wastewater flow through the system shall be distributed on the basis of fixture unit flow in each the buildings serviced by multiplying the proportion of the total fixture flow from each building or facility times the total wastewater flow for the project or installation as determined above.

All sewers shall be located outside of the roadways as much as practical, and minimize the number of roadway crossings. To the extent practical, a sewer from one building shall not be constructed under another building, or remain in service where a building is subsequently constructed over it.

The Contractor shall use the following criteria where possible to provide a layout which is practical, economical and meets hydraulic requirements:

- a. Follow slopes of natural topography for gravity sewers.

- b. Check subsurface investigations for groundwater levels and types of subsoil encountered. If possible, avoid areas of high groundwater and the placement of sewers below the groundwater table.
- c. Avoid routing sewers through areas which require extensive restoration or underground demolition
- d. Depending upon the topography and building locates, the most practical location of sanitary sewer lines is along one side of the street. In other cases they may be located behind buildings midway between streets. The intent is to provide future access to the lines for maintenance without impacting vehicular traffic.
- e. Avoid placing manholes in low-lying areas where they could be submerged by surface water or subject to surface water inflow. In addition, all manholes shall be constructed 50 mm higher than the finished grade, with the ground sloped away from each manhole for drainage.
- f. Sewer lines shall have a minimum of 800 mm of cover for frost protection.
- g. Locate manholes at change in direction, pipe size, or slope of gravity sewers.
- h. Sewer sections between manholes shall be straight. The use of a curved alignment shall not be permitted.
- i. If required by the design, locate manholes at intersections of streets where possible. This minimizes vehicular traffic disruptions if maintenance is required.
- j. Sewer lines less than 1.25 m deep under road crossings shall have a reinforced concrete cover of at least 150 mm thickness around the pipe or shall utilize a steel or ductile iron carrier pipe. It is recommended to continue the reinforced concrete cover or carrier pipe a minimum of one (1) m beyond the designated roadway.
- k. Verify that final routing selected is the most cost effective alternative that meets service requirements.

2.4.3.2 PROTECTION OF WATER SUPPLIES

The Contractor shall ensure that the sewer design meets the following criteria:

- a. Sanitary sewers shall be located no closer than 30 m horizontally to water wells or reservoirs to be used for potable water supply.
- b. Sanitary sewers shall be no closer than 3 m horizontally to potable water lines; where the bottom of the water pipe will be at least 300 mm above the top of the sanitary sewer, horizontal spacing shall be a minimum of 1.8 m.
- c. Sanitary sewers crossing above potable water lines shall be constructed of suitable pressure pipe or fully encased in concrete for a distance of 3 m on each side of the crossing. Pressure pipe will be as required for force mains in accordance with local standards and shall have no joint closer than 1 m horizontally to the crossing, unless the joint is fully encased in concrete.
- d. When sanitary sewers cross water lines the designer shall cross the water line above the sewer line whenever possible. In such cases the water line shall be located a minimum distance of 450 mm above the sewer line or shall be fully encased in concrete for a distance of 3 m on each side of the crossing.

2.4.3.3 GRAVITY SEWER

Sanitary sewers shall be designed in accordance with the AED Design Requirements for Sanitary Sewer and Septic Systems, latest version to flow at a maximum in the following way:

- a. Sanitary sewer laterals, mains and trunk lines flow velocities shall be designed to provide a minimum velocity of 0.6 meters per second (mps),
- b. A minimum velocity of 0.8 mps at the peak diurnal flow rate,
- c. Flows shall be based on allocating the proportion of the average daily or peak daily flow to each building or facility on the basis of fixture unit flow developed for the plumbing design, and
- d. Minimum pipe slopes shall be provided regardless of the calculated flow velocities to prevent settlement of solids suspended in the wastewater. Minimum pipe slopes are provided in the AED Design Requirements for Sanitary Sewer and Septic Systems.

Unless otherwise indicated (see Building Connections and Service Lines), gravity sewer pipe shall be installed in straight and true runs in between manholes with constant slope and direction. Adequate cover must be provided for frost protection. A minimum cover of 800 mm will be required to protect the sewer against freezing.

2.4.3.3.1 MANHOLES

The Contractor shall provide standard depth manholes (MH), (depth may vary) an inside dimension of 1.2 m. Manholes shall be made of cast-in-place reinforced concrete with reinforced concrete cover. Alternate pre-cast manhole option shall taper to a 750 mm cast iron frame that provides a minimum clear opening of 600 mm. In every case, the manholes, frames and covers shall be traffic rated, H-20 load rating. All manholes shall be provided with a concrete bench with a flow line trough, smoothly formed to guide waste flow to the outlet pipe from the inlet pipe(s). The top surface of the bench shall be above the crown of all pipes within the manhole. All surfaces of the bench shall be sloped smoothly toward the trough to guide flow, even under peak flow conditions. Sanitary sewer lines shall enter at the manhole flow line. Where the invert of the inlet pipe would be more than 0.5 meter above the manhole floor, a drop inlet shall be provided. No internal drop structures shall be permitted at lift stations. Inlet to lift station wet wells shall enter below the lowest water level of the pump operating range, and if necessary a drop inlet approach pipe external to the lift station may be used to avoid cascading influent flow. The angle between inflow and outflow pipes converging at a manhole shall not be less than 90°.

2.4.3.3.2 MANHOLE DESIGN REQUIREMENTS

Manholes are required at junctions of gravity sewers and at each change in pipe direction, size or slope, except as noted hereinafter for building connections. Manholes shall be installed at start of all main runs.

2.4.3.3.3 SPACING

The distance between manholes must not exceed 120 m in sewers of less than 460 mm in diameter. For sewers 460 mm and larger, and for outfalls from wastewater treatment facilities, a spacing of up to 180 m is allowed provided the velocity is sufficient to prevent sedimentation of solids.

2.4.3.3.4 PIPE CONNECTIONS

The crown of the outlet pipe from a manhole shall be on line with or below the crown of the inlet pipe.

2.4.3.3.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete, traffic rated in any case to an H-20 load rating. Cast iron frames and covers shall be traffic rated, circular with vent holes.

2.4.3.3.6 STEPS FOR MANHOLES

Steps shall be cast iron, polyethylene coated, at least 15 mm thick, not less than 400 mm in width, spaced 300 mm on center.

2.4.3.4 PIPE

Pipe shall conform to the respective specifications and other requirements as follows: Provide Polyvinyl Vinyl Chloride (PVC) conforming to ASTM D 3034, Type PSM with a maximum SDR of 35, size 380 mm or less in diameter. PVC shall be certified as meeting the requirements of ASTM D 1784, cell Class 12454 B. Minimum pipe sizes for the main lines and laterals shall be 200 mm diameter and service lines shall be a minimum of 150 mm diameter. Contractor may use uPVC pipe provided the SDR and strength properties of the pipe equal or exceed the properties of ASTM D 1784 for PVC.

2.4.3.4.1 FITTINGS

Fittings shall be compatible with pipe supplied and shall have a strength not less than that of the pipe.

Fittings shall conform to the respective specifications and requirements as follows: provide PVC fittings conforming to ASTM D 3034 for type PSM pipe.

2.4.3.4.2 JOINTS

Joints installation requirements shall comply with the manufacturers installation instructions. Flexible plastic pipe (PVC or high density polyethylene pipe) gasket joints shall conform to ASTM D3212.

2.4.3.4.3 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent-cemented saddles as approved. Saddles for PVC pipe shall conform to Table 4 of ASTM D 3034. The minimum depth of the cover over the pipe crown shall be 0.8 m.

2.4.3.4.4 BUILDING CONNECTIONS AND SERVICE LINES

Building connections and service lines will be planned to eliminate as many bends as practical and provide convenience in rodding. Bends greater than 45 degrees made with one fitting should be avoided; combinations of elbows such as 45-45 or 30-60 degrees should be used with a cleanout provided. Connections to other sewers will be made directly to the pipe with standard fittings rather than through manholes. However, a manhole must be used if the connection is more than 30 m from the building cleanout. Tee connections to the main or branch are not allowed. Service connection lines will be a minimum of 150 mm diameter and laid at a minimum 1% grade. Laterals shall be 200 mm and sloped to maintain the minimum velocity as described in paragraph "Gravity Sewer."

2.4.3.4.5 CLEANOUTS

Cleanouts must be installed on all bends of sewer-building connections to provide a means for inserting cleaning rods into the underground pipe. Install manufactured wye fittings. In lieu of a wye fitting, an inspection chamber may be installed. The inspection chamber shall be of the same construction as a manhole. The cleanout will be of the same diameter as the building sewer, and never be smaller than 150 mm. If there are no bends in the sewer building connection, a cleanouts shall be installed within 1 m from the building.

2.4.3.5 GREASE TRAP

Grease traps are used to remove grease from wastewater to prevent it from entering the sanitary sewer. All Dining Facilities (DFACs) shall incorporate preliminary treatment with use of a grease trap prior to the sanitary sewer system. The only waste lines upstream of the grease trap shall be grease laden waste from the kitchen or other areas. Grease trap design shall be based on AED Design Requirements - Grease Trap, latest version. The grease trap shall be of reinforced cast-in-place concrete, reinforced precast concrete or equivalent capacity commercially available steel, with removable three-section, 9.5 mm checker-plate cover, and shall be installed outside the building. Steel grease traps shall in be installed in a concrete pit and shall be epoxy-coated to resist corrosion as recommended by the manufacturer. Concrete shall have a minimum compressive strength of 21 MPa at 28 days. The grease trap shall connect to the sanitary sewer system.

Contractor shall provide bollards around the tank and construct a minimum 4 m wide access road from the closest roadway to the grease trap for a pump truck. The access road shall be of the same material as the main roads in the compound. Under no circumstance shall the grease trap be installed inside the building. Provide outside water spigot for cleaning.

2.4.3.6 FIELD QUALITY CONTROL

2.4.3.6.1 FIELD TESTS AND INSPECTIONS

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment and incidentals required for testing.

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically a full circle of light through the pipeline when viewed from the adjoining end of the line. When pressure piping is used in a non-pressure line for non-pressure use, test this piping as specified for non-pressure pipe.

Test lines for leakage by either infiltration tests or exfiltration tests. Prior to testing for leakage, backfill trench up to at least lower half of the pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe to prevent movement during testing, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

Infiltration tests and ex-filtration tests: Perform these tests for sewer lines made of specified material, not only concrete, in accordance with ASTM C 969M, ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969M and ASTM 969.

Perform Low Pressure Air tests as follows:

- a. Concrete pipe: Test in accordance with ASTM C 924M, ASTM C 924. Allowable pressure drop shall be given in ASTM C 924M ASTM C 924. Make calculations in accordance with the Appendix to ASTM C 924M, ASTM C 924;
- b. Ductile-iron pipe: Test in accordance with the applicable requirements of ASTM C 924M, ASTM C 924. Allowable pressure drop shall be as given in ASTM C 924M, ASTM C 924. Make calculations in accordance with the Appendix to ASTM C 924M, ASTM C 924;
- c. PVC Plastic pipe: Test in accordance with applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

2.4.3.6.2 DEFLECTION TESTING

Deflection testing will not be required however; field quality control shall ensure that all piping is installed in accordance with deflection requirements established by the manufacturer.

2.4.4 WASTEWATER TREATMENT LAGOON SYSTEMS

A Partial mix aerated wastewater treatment lagoon system shall be designed in accordance with AED Design Requirements - Package Wastewater Treatment Plants and Lagoons, latest version.

2.4.4.1 WASTEWATER TREATMENT LAGOON SYSTEM

The partial mix aerated wastewater treatment lagoon system shall be designed to accommodate the wastewater hydraulic load as discussed in Section 01010. The wastewater treatment lagoon system shall be designed and constructed such that it operates with the ability to process inflow rates based on the calculated peak hourly flow. Feed rate to the plant components shall be determined by the Contractor from the analysis of the installation peak flow and average daily flow evaluation. All treatment train components shall be designed and constructed in parallel treatment systems with bypass capability in order to continue wastewater treatment while performing maintenance on a particular component in the treatment train.

2.4.4.2 REQUIREMENTS OF DESIGN

Wastewater Hydraulic Load: Individual wastewater generation rate as specified in Section 01010. Design to pass 125% of design capacity without overflowing.

Influent Characteristics of Wastewater:

- a. BOD₅ – 400 mg/L or based on 0.09 kilograms (0.20 pounds) per person per day whichever is greater loading.
- b. TSS – 400 mg/L
- c. TKN – 80 mg/L
- d. Fecal Coliform – 10⁸ MPN /100 mL

Effluent Criteria Limitations for Direct Surface Water Discharge:

- a. BOD₅
- b. The 30-day average will not exceed 30 mg/L
- c. The 7-day average will not exceed 45 mg/L
- d. CBOD₅ may be substituted for BOD₅. In those cases the following limits will apply:
 - 1. 30-day average will not exceed 25 mg/L
 - 2. The 7-day average will not exceed 40 mg/L

Note: Parameter CBOD₅ limit, if substituted for the parameter BOD₅, should be at least 5 mg/L less than each numerical limit for the thirty (30) day and seven (7) day average for the BOD₅ limit. The CBOD₅ test procedure suppresses the nitrification component in the BOD₅ test procedure, thereby reducing the value or effects and lowering the oxygen demand.

- e. TSS
- f. The 30-day average will not exceed 30 mg/L.
- g. The 7-day average will not exceed 45 mg/L.
- h. pH
- i. The effluent pH values will be maintained between 6.0 and 9.0.

Temperature Ranges: see the mechanical section for the range of temperatures that apply.

Processes: To be determined by the Contractor as part of the scope of work subject to Government approval as required in AED Design Requirements - Package Wastewater Treatment Plants and Lagoons latest version.

2.4.4.3 LAGOONS

The Contractor shall design the lagoons in accordance to the AED Design Requirements - Package Wastewater Treatment Plants and Lagoons latest version. The lagoons shall be lined with a geomembrane liner with a hydraulic conductivity no greater than 1×10^{-7} cm/sec.

2.4.4.4 FLOW SPLITTING

For multiple treatment trains, provide flow splitting capabilities to evenly distribute flow to each treatment train with broad adjustable rectangular weirs. Plant influent shall be conveyed directly into the flow lagoon basins.

2.4.4.5 INLET BAR SCREEN

A bar screen shall be provided prior to flow equalization to remove large solids from the incoming raw sewage. The bar screen will be fabricated from 13 mm diameter bars spaced 25 mm apart. The bars shall be sloped to permit easy cleaning of accumulated debris. A deck shall be furnished for drying the debris. Minimum area of bar screen shall be 0.9 m x 0.9 m.

2.4.4.6 FLOW EQUALIZATION

Provide flow equalization volume designed to attenuate maximum peak flows equal to 150% of the design flow for two hours. Flow control to the lagoons shall be accomplished by gravity flow of the influent. Flow conduit to the lagoons shall contain broad adjustable rectangular discharge weirs. The broad weirs will be adjustable so that a measured amount of influent will flow to the lagoons.

2.4.4.7 CHLORINE CONTACT CHAMBER

A chlorine contact chamber will be provided for proper disinfection of the treated waste water prior to discharging from the plant. The chlorine contact chamber will have appropriate detention time based on the design flow to meet effluent standards. Sufficient flow baffles will be supplied to ensure proper mixing of the chlorine solution with the plant effluent and detention time.

2.4.4.8 HYPOCHLORITE SYSTEM

Provide a liquid chlorine (hypochlorite) feed system sized to satisfy all disinfection requirements at the waste water treatment plant. It is anticipated that calcium hypochlorite will be delivered to the plant in the small containers and stored in the existing Chemical Building 803. No other chemicals, cleaning solvents, lubricants, etc. are to be stored in the dedicated space. The hypochlorite feed system will consist of batch mix/feed storage tanks, positive displacement metering pumps, piping, valves and other appurtenances, and pump controls. For redundancy, provide a dedicated metering pump for each treatment train. It is anticipated the hypochlorite system will be located in the Chemical Building 803.

Provide one (1) 400 liter fiberglass reinforced plastic or polyethylene mix/feed tanks. Preliminary tank size based on commercial strength 12.5% hypochlorite batch solution, and assumption that 45 kilograms of calcium hypochlorite batched in each tank. Tanks shall be elevated on a pad for housekeeping and to provide a flooded metering pump suction, and shall come with hinged cover, top mounted mixer, and 25 mm bottom outlet connection. The Contractor shall provide concrete secondary containment for the mix/feed tank. The concrete secondary containment shall provide a minimum total of 900 liter capacity. Mixers shall have local, manual on/off control. Hypochlorite metering pumps shall be positive displacement type with stroke and speed control. The pumps shall be capable of adjustable speed operation using DC SCR drive and shall be flow-paced off a flow signal from the lagoon system. Coordinate pump motor type with drive unit provided. Metering pumps shall have capacity to dose minimum 10 mg/L chlorine or as required to meet applicable discharge limits, whichever is greater. Provide a dedicated pump for each treatment train. At a minimum, each metering pump shall be provided with the following appurtenances: Pulsation dampener, adjustable diaphragm backpressure valve, adjustable pressure relief valve, calibration column, pressure indicator with diaphragm seal, Y-strainer. Provide a suitable diffuser or injection assembly for dispersing chemical at the point of application.

Provide non-potable dilution water for batching the dry calcium hypochlorite. Provide appropriate protective clothing and eye protection. Provide an emergency shower and eyewash station in the chlorine feed building.

Chlorine feed piping shall be 13 mm schedule 80 PVC. Provide double walled containment for chlorine lines between the feed building and the point of application. Provide isolation valves to allow equipment to be isolated for maintenance.

Provide power, control wiring and dilution water as required for a complete and operable system.

2.4.4.9 CENTRAL CONTROL PANEL

A central control system installed within a weatherproof building shall be provided. The electrical controls will consist of magnetic starters, program timers and switches necessary to automatically control all electrical devices and/or motors on the waste water treatment system.

Manual-off-auto selector switches and magnetic starters in conjunction with the program timer will control the blower/motor. The program timers will have the capability to operate the treatment system when required as determined by the variation in the daily flow rate. Properly sized circuit breakers and fuses will protect all electrical equipment and circuitry. The control system will be designed to operate all duplex or standby equipment.

Electronic flow meters shall be installed at appropriate locations on inflow and outfall locations to monitor influent and effluent flows. The controls and monitors shall be located at the central control panel.

2.4.4.10 ACCESS LADDER, WALKWAYS AND HANDRAILS

Provide an access ladder to each structure above grade. Provide service walkways with handrails to service the plant equipment. Walkways shall be a minimum 0.9 m. Provide service walkways between trains and other plant structures so each structure can be accessed without having to climb back down a ladder.

2.4.4.11 PIPING

All piping within the plant will be Schedule 40 steel pipe.

2.4.4.12 VALVES

The Contractor shall install bypass valves and piping so that each component in the process train can be bypassed for maintenance.

2.4.4.13 SLUDGE DRYING BEDS

Design and construct sludge drying beds as necessary. Convey sludge from lagoons to beds by gravity. Provide isolation valves to each bed and splash plate in front of outlet to spread the sludge over the bed and prevent erosion of the sand.

Beds shall be capable of holding 0.3 m of liquid sludge. Profile the following bed layers:

- a. 0.3 m top layer of uniform coarse sand (effective size between 0.3 to 0.75 mm)
- b. 0.1 m intermediate layer of uniform fine gravel (effective size between 4 to 5 mm)
- c. 0.1 m bottom layer of uniform coarse gravel (effective size between 20 to 25 mm)

Slope bed subgrade to drain to drainage laterals. Encase drainage laterals in 0.1 m of uniform coarse gravel. Drainage lateral shall be 0.1 m below bottom gravel layer. Slope drainage laterals and header a minimum of 1% to drain to lift station. Drainage laterals shall be perforated ASTM 3034 100 mm PVC pipe with two rows of holes 13 mm in diameter on 120 mm centers and 120° apart. Space laterals evenly at 3 m apart. Lateral are to run entire length or width of bed. Manifold laterals to common ASTM 3034 150 mm PVC header. Locate feed pipe at opposite end of access point for dried sludge removal equipment (e.g. bulldozer) . Slope bed side walls at 2H:1V slope.

The Contractor shall design and construct effluent recirculation system for the excess effluent that collects in the drying beds. The effluent recirculation system shall consist of pumps, piping, and appurtenances that will convey effluent to the lagoon system.

2.4.4.14 RECLAIMED WATER SYSTEM (GREY WATER)

Additionally, a reinforced concrete holding (irrigation) pond with weir overflow capable of retaining 100,000 liters of treated effluent shall be designed and constructed at the end of the treatment process. Water exiting the treatment system shall flow through this holding pond. A pump and distribution system shall be constructed to deliver 100 liters/minute from the irrigation pond to the camp irrigation system. The water distribution system shall be designed, constructed, and tested per the requirements of Section 01010-2.4.2. All outlets of this line shall be labeled "Irrigation Use Only – Not For Drinking". Wastewater shall be adequately treated and disinfected for end use as irrigation. Final discharge shall meet World Health Organization standards.

2.4.4.15 SITE SURVEY AND PLAN REQUIREMENTS

Topographic survey and geotechnical investigation of the proposed sewage treatment site is required and the Contractor shall design the package wastewater treatment system to be compatible with site and soil conditions.

Wastewater Lagoon Site Survey. The Contractor shall conduct a topographic survey to determine existing site characteristics. The Contractor shall conduct a utility survey to determine the locations of any nearby security fences and buildings, water lines, wells, sanitary sewers, storm sewers and communication/electrical lines. The Contractor shall provide survey for all outfall piping locations and the outfall area in the existing wadi to include topographic survey of a minimum of 20 m on both sides of the proposed outfall location.

Waste water Treatment Lagoon Layout. The Contractor shall design a layout for the system to include all lagoon geometry, waste water inlet and off loading station configurations, number of process compartments, yard piping, bypass valves, surface aerators, effluent contact chambers and discharge facilities including the outfall system, and sludge drying, sludge drying water recirculation piping and sludge disposal facilities, holding pond, and related site preparation and earthwork. See waste water treatment plant design submittal requirements.

2.4.4.16 START UP TESTING

The Contractor shall include a proposed start-up testing and training program in the operation and maintenance manuals. When the wastewater system construction nears completion and all units are operative, the Contractor shall commence a commissioning and startup procedure for the treatment system. The treatment system includes all treatment plant units and associated equipment, and sludge holding and digestion. The Contractor shall operate the treatment facility for a trial period of two months performing all daily and weekly operation and maintenance (O&M) tasks recommended by the equipment manufacturer. The Contractor shall utilize services of qualified operators; including the use of at least two Afghan Nationals that the Contractor shall train. During the routine O&M, the Contractor shall perform all sampling and testing necessary to ensure proper daily operations in achieving the required effluent standards. The Contractor shall maintain a log that includes records of daily O&M activities, e.g. repairs, inflow measurement, aeration cycles, effluent cycling, waste and return sludge pumping, and sludge drying. The Contractor shall also maintain and operate the sludge disposal operation during the trial period.

2.4.5 STORM SEWER SYSTEMS

2.4.5.1 DESIGN STORM RETURN PERIOD (BASELINE FREQUENCY)

Developed portions of the site installation such as administration, industrial and barracks areas, shall be based on a rainfall of 10-year frequency. Basic system design shall be in accordance with UFC 3-230-

17A, Chapter 2. Potential damage or operational requirements may warrant a more severe criterion or in certain areas a lesser criterion may be appropriate. The design of roadway culverts and other on-site storm drainage features & structures will be based on 10-year rainfall event. Protection of installations against flood flows originating from areas exterior to the base installation shall be based on a minimum 25-year rainfall event.

2.4.5.2 STORM DRAINAGE SYSTEM DESIGN

The Contractor shall be responsible for the complete design of the storm drainage system. Drainage of runoff from unpaved areas onto pavements shall be minimized. If storm drain piping is required it shall comply with the requirements in this section. Where storm drain pipes are of different diameters, the pipe crown elevations should be matched at the drainage structure. Storm drain lines shall be located outside of paved areas to the extent possible. Under no circumstance shall storm drain lines be located beneath buildings. All open storm drainage channels shall be concrete lined. Erosion control shall be provided for all storm drain structures during construction. Water from roof down spouts shall be drained off building site. All storm drain pipe and structures shall comply with the requirements specified in Specification Section 33 40 01 STORM DRAINAGE. For cases when there is a need to penetrate the perimeter wall for drainage purposes (outfall), multiple wall penetrations shall be used to provide redundancy. Each drainage penetration through the perimeter wall shall be protected from unauthorized ingress/egress through the use of grates or rebar.

2.4.5.3 HYDRAULIC DESIGN

New storm drain pipes shall be designed for gravity flow during the design storm baseline unless otherwise approved by the Government. The hydraulic grade line shall be calculated for the storm drain system and all energy losses accounted for. Design computations shall adhere to procedures contained in UFC 3-230-17A. Storm drain systems shall be designed to provide a minimum flow velocity of 0.75m/s and a maximum velocity of 2m/s.

2.4.5.4 AREA INLETS

Area inlets shall be properly sized and designed to accommodate the design flows. All grates shall be of a "bicycle safe" design.

2.4.5.4.1 CONCRETE PIPE

Reinforced concrete pipe shall be a minimum Class III. Type I cement may be used only when sulfates in the soil are 0.1 percent or less and dissolved sulfates in the effluent are 150 ppm or less. Type II cement may be used only when sulfates in the soil are 0.2 percent or less and dissolved sulfates in the effluent are 1,500 ppm or less. Only Type V cement may be used if sulfates in the soil exceed 0.2 percent or dissolved sulfates in the effluent exceed 1,500 ppm. Concrete pipe shall be assumed to have a minimum design service life of 50 years unless the Contractor determines that conditions at the site will reduce the service life. Concrete culverts and storm drains shall be protected by a minimum of 1 m of cover during construction to prevent damage by heavy construction equipment.

2.4.5.4.2 PLASTIC PIPE

Stiffness of the plastic pipe and soil envelope shall be such that the predicted long-term deflection shall not exceed 7.5 percent. Plastic culverts and storm drains shall be protected by a minimum of 1 m of cover during construction to prevent damage by heavy construction equipment. Split couplers shall not be allowed for corrugated high-density polyethylene pipe. Plastic pipe shall be assumed to have a minimum design service life of 50 years unless the Contractor determines that conditions at the site will reduce the service life (then plastic pipe shall not be used).

2.4.6 OIL WATER SEPARATORS

Oil/water separators shall be utilized for all drains from the vehicle wash racks. Separators shall be located for easy maintenance and cleaning.

2.5 EARTHWORK AND FOUNDATION PREPARATION

2.5.1 CAPILLARY WATER BARRIER

Bedding material for slabs on grade shall be coarse graded gravel with little or no fines to prevent surface water from migrating up and maintaining contact with the bottom surface of the building slab. Graded material shall comply with ASTM C 136 test method for sieve analysis of gravels with only 3 percent by weight passing the 37.5mm (1.5 inch) size sieve, and no more than 2 percent by weight passing the 75 micrometers (No. 200) size sieve, and conforming to the soil quality requirements specified in the paragraph entitled "Satisfactory Materials."

2.5.2 SATISFACTORY MATERIALS

Any materials classified by ASTM D 2487 as GW, GW-GM, GW-GC, SW, SW-SM, or SW-SC and free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.5.3 UNSATISFACTORY MATERIALS

Any materials which do not comply with the requirements set forth in the Satisfactory Materials paragraph. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75 mm. The Contracting Officer shall be notified of any unsatisfactory materials.

2.5.4 CLEARING AND GRUBBING

Unless indicated otherwise, remove tress, stumps, logs, shrubs, brush and vegetation, and other items that would interfere with construction operations within lines 1.5 m outside of the building and structure line. Remove stumps entirely. Grub out matted roots and roots over 50mm in diameter to at least 460 mm below existing surface.

2.5.5 STRIPPING

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be stockpiled and used for backfilling. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

2.5.6 EXCAVATION AND COMPACTION OF FILL

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with satisfactory material and compact to at least 95% of the maximum dry density, as determined by the Modified Proctor laboratory procedure. ASTM D 1557 shall be used for producing the Modified Proctor moisture-density curve, unless the soil to

be compacted includes more than 30% retained on the 19 mm sieve. In this case, the Contractor must replace the ASTM D 1557 laboratory compaction procedure with AASHTO T 180, Method D, corrected with AASHTO T 224.

During compaction, the moisture content of the soil shall be within 1.5% of the optimum moisture content, as determined by the Modified Proctor laboratory procedure. The thickness of compacted lifts shall not exceed 15 cm and the dry density of each compacted lift shall be tested by either sand cone (ASTM D 1556) or nuclear gage (ASTM D 2292). If the nuclear gage is used, it must first be compared to sand cone tests for each soil type to verify the accuracy of the nuclear gage measurements for moisture content, wet density, and dry density. Furthermore, every tenth nuclear gage test must be accompanied by a sand cone test and these verification data must be summarized and submitted to the Contracting Officer. Density tests shall be performed at a frequency of not less than one test for each 200 square meters and not less than two tests per compacted lift.

2.6 GEOTECHNICAL

2.6.1 SOIL INVESTIGATION

Existing geotechnical information is not available at the project site. Any site-specific geotechnical data required to develop foundations, fill at elevated slabs, materials, earthwork, and other geotechnical related design and construction activities for this project shall be the Contractor's responsibility. The Contractor shall develop all pertinent geotechnical design and construction parameters by appropriate field and laboratory investigations and analyses. The Contractor shall produce a detailed geotechnical report that includes:

- a. Clear description of the anticipated construction including planned grading and structural details to provide an estimation of foundation loads (compression, uplift, lateral, and moment) and settlement tolerance.
- b. Detailed site and area reconnaissance that includes a description of local geology and origin of sediments, surface features (e.g., ditches or other excavations, existing structures, vegetation, rock outcrops, seeps or springs), surface soil type(s), and subsurface lithology).
- c. Justification of number and depth of borings.
- d. Site plan illustrating exploratory boring locations.
- e. Boring logs that include groundwater levels (if encountered).
- f. Field tests and analyses (e.g., Unified Soil Classification System, field density, SPT).
- g. Analytical laboratory test results in accordance with ASTM or other recognized standards (e.g., sieve analysis, Atterberg Limits (plastic and liquid), moisture content, hydrometer, consolidation/collapse potential, specific gravity of solids, direct shear, density, chemical [sulfate, chloride, pH, lime], K values) and any other tests as needed to properly conduct necessary calculations to determine the engineering properties of the soil.
- h. A summary of the results of the subsurface geotechnical conditions including allowable soil bearing capacity, foundation recommendations, pavement design criteria, and construction materials (e.g. concrete cement, asphalt, and aggregates).

Two copies of the geotechnical report shall be submitted to the COR. Foundations, including sub-grade, shall be designed and constructed based on calculations and recommendations from a licensed structural engineer provided by the Contractor.

For standard penetration test (SPT), the Contractor shall use ASTM D1586. All geotechnical laboratory and field work shall be based on standards set forth in the ASTM. Contractor shall not use any DIN standards for penetration tests in lieu of ASTM D 1586. Soil investigations shall be in accordance with AED Design Requirements: Geotechnical Investigations for USACE Projects, latest version, or most recent version.

For foundation design, allowable soil bearing pressures shall be determined by calculations made based on the physical and mechanical properties obtained from laboratory testing. The soil bearing pressures calculated shall be compared with the International Building Code (IBC) 2006 Table 1804.2. The lower of the two bearing pressures, calculated or Table 1804.2, shall be chosen for the allowable soil bearing pressure.

California Bearing Ratio (CBR) tests shall be conducted on the existing soils throughout the proposed road alignment and vehicle parking and maneuver areas. Results from the tests shall be used to calculate the pavement structure using the minimum pavement structure as dictated in paragraph 2.3.4 as a reference. In the event that the calculations based on the CBR tests reveal that the pavement structure dictated in paragraph 2.3 is insufficient to carry the design load, the Contractor shall design and construct a subbase layer for the pavement structure.

The Contractor shall conduct soils classification per ASTM D 2487-06.

No design review submittal shall be considered complete without an approved geotechnical report. Geotechnical investigation plans and report of investigations shall be submitted promptly in accordance with Section 01335.

2.6.2 GEOTECHNICAL QUALIFICATIONS

A geotechnical engineer that is a member of a geotechnical firm responsible to the Contractor shall oversee all geotechnical engineering design parameters. The geotechnical engineer shall be qualified by:

- a. Education in geotechnical engineering;
- b. Professional registration;
- c. Minimum of ten (10) years of experience in geotechnical engineering design.

The geotechnical firm conducting the field investigation and laboratory work shall be certified by the Chief, Quality Assurance Branch USACE-AES or Chief, Quality Assurance Branch USACE-AEN. Certification document shall be submitted as part of the Geotechnical Report.

3.0 STRUCTURAL

3.1 GENERAL

The structures shall consist of reinforced concrete footings supporting a variety of structure types.

3.2 DESIGN

Design shall be performed by or under the direct supervision of the Contractor's structural engineer. The structural engineer shall be a registered Professional Engineer. All structural design documents shall be stamped and signed by the structural engineer. Calculations shall be in SI (metric) units of measurements.

3.3 STANDARDS

The Contractor should use the following American standards to provide structural design if local standards are not available, relevant, or applicable. All codes are latest edition.

Concrete

ACI 318 and ASTM C 39

Steel Reinforcement	ASTM A 615
Anchor Bolts	ASTM F 1554; Grade 36 steel.
Bolts and Studs	ASTM A 307.
Concrete Masonry Units	ASTM C 90; Type I (normal weight, moisture control).
Mortar	ASTM C 270; Type S (ultimate compressive strength of 13 MPa).
Grout	ASTM C 476; 14 MPa (2,000psi) minimum compressive strength @ 28 days (Slump between 200 mm to 250mm).
Structural Steel	ASTM A 36; 250 MPa ($F_y = 36,000\text{psi}$).
Welding	AWS D1.1 (American Welding Society).
Cold-Formed Steel	AISI Specification for the Design of Cold-formed Steel Structural Members

3.4 DESIGN LOADS (DEAD & LIVE)

Dead loads shall be in accordance with ASCE 7-05 Minimum Design Loads for Buildings and Other Structures. Dead loads consist of the actual weight of all materials of construction incorporated in the buildings. Live loads shall be per Chapter 4. All facilities shall be classified as a minimum of Category II in accordance with Table 1-1.

3.5 WIND LOADS

Wind loads shall be calculated in accordance with ASCE 7-2005 using a "3-second gust" wind speed of 135 km/hr. Exposure = C. Importance Factor = 1.0.

3.6 SEISMIC

Seismic design of all structures in southern Afghanistan shall be in accordance with ASCE 7-05. Seismic Acceleration Parameters shall be $S_s = 1.28g$ and $S_1 = 0.51g$.

3.7 REINFORCED CONCRETE

All concrete members shall be designed and constructed in accordance with the provisions of the American Concrete Institute, Building Code Requirements for Structural Concrete, ACI 318. A minimum 28 day compressive strength of 28 MPa shall be used for design and construction of all concrete. Concrete shall have maximum water-cement ratio of 0.45. Per ACI 211, Table 6.3.4 the strength will be higher than the specified 28 MPa. Reinforcing steel shall be deformed bars conforming to American Society for Testing and Materials publication ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement. The minimum yield strength F_y shall be 420 MPa.

No concrete shall be placed when the ambient air temperature exceeds 32 degrees C unless an appropriate chemical retardant is used. In all cases when concrete is placed at 32 degrees C or hotter it shall be covered and kept continuously wet for a minimum of 48 hours.

3.8 MASONRY

Masonry shall be designed and constructed in accordance with the provisions of Building Code Requirements for Masonry Structures, ACI 530/ASCE 5/TMS 402, latest editions. Mortar shall be Type S and conform to ASTM C 270. All masonry used below grade shall be fully grouted. All cells of exterior reinforced CMU walls shall be fully grouted. For interior CMU walls, only the reinforced cells need to be grouted. All CMU walls shall have reinforced horizontal bond beams at a maximum spacing of 1,200 mm on center.

3.9 STRUCTURAL STEEL

Structural steel shall be designed and constructed in accordance with the provisions of American Institute of Steel Construction (AISC), Specifications for Structural Steel Buildings.

3.10 COLD-FORMED LIGHT GAUGE STEEL

Design of cold-formed steel structural members shall be in accordance with the provisions of American Iron and Steel Institute (AISI), Specifications for Design of Cold-Formed Steel Structural Members.

3.11 CORRUGATED METAL ROOFING

Design of cold-formed steel structural members shall be in accordance with the provisions of American Iron and Steel Institute (AISI), Specifications for Design of Cold-Formed Steel Structural Members.

3.12 FOUNDATIONS

All structures shall be provided with a reinforced concrete foundation properly placed on suitable native or compacted earth and shall be prepared in accordance with the recommendations from the geotechnical investigation. Where frost protection is required, the perimeter foundation shall be founded a minimum of 800 mm below final grade.

All foundations have been or shall be designed for a maximum soil bearing capacity of 0.75 kg/cm^2 . A geotechnical investigation shall confirm bearing capacity to be no less than 0.75 kg/cm^2 . If geotechnical investigation shows less than 0.75 kg/cm^2 , the Contractor shall redesign the foundation based on the values provided in the geotechnical investigations.

4.0 ARCHITECTURAL REQUIREMENTS

4.1 GENERAL

All material approved shall become standardized material to be used throughout the facilities under contract. Different sub-contractors shall not use different material or standards under the contract. Intent of the project is to use locally procured materials (unless specified otherwise) and labor to the maximum extent possible while satisfying seismic, international building code, and national fire protection agency life safety code. Conflicts between criteria shall be brought to the attention of the Contracting Officer for resolution. In such instances, the Contractor shall furnish all available information with justification to the Contracting Officer.

4.2 DESIGN CRITERIA

Schematic designs for the facility types requested in this proposal are provided in the Appendix. These designs shall be used to create a complete and usable facility meeting the minimum requirements stated in these documents. The Codes, Standards, and Regulations listed in these documents shall be used in the construction of this project. The publications shall be the most recent editions. Standards other than those mentioned may be accepted provided they meet the minimum requirements and the Contractor shall submit proof of equivalency to the Contracting Officer for approval.

IBC - International Building Code, latest edition

NFPA 101 - Life Safety Code, latest edition

4.2.1 PREMANUFACTURED ARCH-SPAN COMPONENTS

Provide a complete Pre-Engineered Building. All Arch-Span exterior penetrations shall be designed and pre-manufactured off-site using modular design techniques that shall be applied for both structural and finish construction components.

Provide complete architectural and engineering services from project inception through completion of construction.

Prior experience in design and support of major industrial complexes, military bases, ministry projects, as well as public and private projects and provides a wide range of engineering services in Afghanistan or other similar building environments is highly desirable.

Minimize field assembly to the highest extent possible. Pre-manufactured elements are to include Doors, Windows, Vent Louvers and other exterior membrane penetrations.

Pre-engineer and fabricate to engineered design specifications under controlled conditions, to ensure consistent quality and maximum load bearing capabilities.

Specifications shall address the following criteria:

- High strength-to-weight ratio.
- Use of non-combustible material.
- Wind and seismic resistance.
- Compatibility with most decking and roofing systems.
- Modular design.

The Arch-Span system shall meet or exceeds local and international building codes and seismic standards.

Structural and architectural components shall be designed as integral components, so that the site erection is quicker.

The building system shall be fully insulated using non-flammable and non-toxic spray on systems and allow for fully heated, cooled, or refrigerated facilities.

Materials management is an important element in project planning and control. Materials represent a major expense in construction, so minimizing *procurement* or *purchase* costs presents important opportunities for reducing costs.

The availability of materials may greatly influence the schedule in projects with a *fast track* or very tight time schedule.

Provide management of long lead items on all of our projects allowing sufficient time for obtaining the necessary materials.

For projects involving the large scale use of critical resources procurement must obtain materials with the best price/performance characteristics specified by the designers.

All testing is conducted in accordance with the latest specifications. The G.C shall have a complete line of field testing equipment, and can mobilize it to any location, and conduct comprehensive tests and analysis of conditions in-the-field.

Samples received are processed using various technologies and all samples are processed in adherence to a strict quality assurance program.

4.2.2 LIFE SAFETY/ FIRE PROTECTION/ HANDICAPPED ACCESSIBILITY

A life safety and fire protection analysis shall be completed prior to construction commencement for all buildings designed by the Contractor. This analysis shall be documented in plans and in the design analysis. All spaces shall be classified following NFPA 101 or IBC. Whichever code is used shall be stated and referenced in the life safety plan. The facility shall comply with all other safety requirements of the NFPA 101. To the extent possible, all facilities shall be designed in accordance with recognized

industry standards for life safety and building egress. An adequate fire alarm system, fire extinguishers, and smoke alarms shall all be included as required. Due to the lack of adequate water volume and pressure, sprinkler systems are not feasible. In keeping with the intended function of these facilities, handicapped accessibility will not be incorporated in this project. Due to the war contingency requirement, it is assumed that only able-bodied military and civilian personnel will use the facilities listed herein.

4.2.3 ANTI TERRORISM / FORCE PROTECTION

Force protection/anti-terrorism measures for this location shall be followed and incorporated into this project as indicated, in accordance with the referenced DoD Regulations. Information regarding force protection may be found herein and at the following link: www.tisp.org. UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings, including change 1, 22 January 2007; is the primary DoD AT/FP regulation for projects.

4.3 CONCRETE

4.3.1 FINISH

Horizontal finish shall be troweled or screed. If finish is exposed concrete, then the floor shall be a broom finish for texture and shall not interfere with sloping for drainage of the surface. Vertical work shall have a form finish. Exposed concrete shall be sealed with an approved sealer.

4.3.2 PRECAST

Storage of precast units shall be in a dry place or materials shall be covered with a plastic or protective layer. Units shall be detailed to provide size, shape and location of installation. Precast units shall meet the minimum concrete strength requirements.

4.4 MASONRY

Storage of masonry materials shall be in a dry place or materials shall be covered with a plastic protective layer. Cover open walls each day to keep them protected and dry. Masonry construction systems shall be reinforced.

4.4.1 CONCRETE MASONRY UNITS

Concrete masonry units (CMU) for exterior walls shall be either 290 mm wide x 390 mm x 190 mm high or otherwise as shown on the standard drawings. They shall be installed in running bond level and plumb. Mortar joints shall be 10 mm on all sides between CMU. Joints shall be struck with a concave tool to provide a smooth recessed curved surface. Install only quality units. The surface shall be free of chips, cracks, or other imperfections that would detract from the overall appearance of the finished wall. Defective CMU or mortar shall be rejected.

4.5 STONE

Stone type shall be identified for approval in design. Mortar shall be of lower strength than stone and weep holes shall be provided in cavity wall systems.

4.6 THERMAL PERFORMANCE OF EXTERNAL BUILDING ASSEMBLIES

External building assemblies shall meet the requirements of TI-800, Design Criteria, UFC 3-400-01 Design: Energy Conservation, and ASHRAE Standard 90.1, latest editions, but shall meet the following minimum requirements:

Assembly	Minimum Thermal Value
Exterior walls (above grade)	RSI 2.280 (R 13)
Ceilings/roof	RSI 5.284 (R 30)
Floor (over unheated space)	RSI 3.346 (R 19)

Exterior doors	RSI 0.252 (R 1.43)
Exterior windows/(glazing within doors)	RSI 0.308(R 1.75)
Skylights	RSI 0.180 (R 1.02)

This table is a summary of ANSI/ ASHRAE 90.1 Table 5.5-5, Climate Zone 5 (A,B,C)

RSI measured in K-m²/W, R measured in SF-F-hr/BTU. 1 K-m²/W = 5.678 SF-F-hr/BTU.

The building design shall utilize solar heating by orientating the buildings and wind breaks, insulation and exterior window shading techniques to reduce building heat loss and heat gain. Contractors shall include energy efficient heating and cooling solutions to minimize energy consumption.

4.7 ROOFING AND WEATHERPROOFING

All buildings shall have a sloped metal roof, with metal eaves, and soffits. All exterior entry ways to be covered and protected by rain gutters and diverters as to not have water falling on the entry ways to all buildings. All roof lap joints (except Arch-Span) shall be sealed with butyrate sealant.

4.7.1 SLOPED ROOFS

A sloping roof shall be as defined in the IBC. On sloping roofs provide and install 0.60 mm galvanized steel in either corrugated or standing seam design. Use 0.75 mm for pre-denotation roof issues which should be augmented with sand bags in the ceiling below the metal roofing. Metal roofing shall be anchored to the steel "Z" purlins using exposed fasteners at 300 mm on center at all seams and at 600 mm on center in the panel field. Fasteners shall be placed at the top of the corrugation taking care not to dent panel. Roof sealant or adhesive shall be placed over each anchor head. Roofing system shall include all edge, ridge and penetration flashings necessary for a watertight installation and as described in this section. Roofing shall be galvanized mil finish. Panels shall be overlapped two corrugations side to side and be continuous sheets from ridge to eave. Provide continuous ridge vents on all gable roofs.

4.7.1.1 INSULATION

Provide a 50 mm thick extruded polystyrene rigid thermal insulation boards, conforming DIN, EN 13164 BS, EN 13164, k=0.2 @ 75 degrees F mean temperature, 2.82 kg/sq cm compressive strength, hydrophobic, Type VI. Provide thickness by multiple boards to meet the designed R-value. Comply with insulation manufacturer's instructions and recommendations for handling, installing, and bonding or anchoring insulation to substrate. Insulation boards shall be installed loose, without glue, in staggered manner. Attention should be paid not to leave separation along edges. Where overall insulation thickness is 50 mm or greater, install required thickness in two layers with joints of second layer offset from joints of first layer a minimum of 300 mm each direction. Trim surface of insulation where necessary at roof drains so completed surface is flush with drain ring. Polyester felt or geotextile shall be installed over insulation layers as a filter layer to prevent the passage of fines in gravel layer to lower strata.

4.8 CONNECTIONS AND JOINTING

4.8.1 SOLDERING

Soldering shall apply to copper and stainless steel items. Edges of sheet metal shall be pre-tinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pre-tinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

4.8.1.1 SEAMING

Flat-lock and soldered-lap seams shall finish not less than 25 mm wide. Unsoldered plain-lap seams shall lap not less than 75 mm unless otherwise specified. Flat seams shall be made in the direction of the flow.

4.8.1.2 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 3 mm apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 300 mm on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

4.9 METAL

4.9.1 MATERIALS

Any metal listed by ASTM, DIN, BS or EN standards. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in ASTM, DIN, BS or EN standards. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

4.9.1.1 STEEL SHEET, ZINC-COATED (GALVANIZED)

Zinc coated steel conforming to ASTM A 525, DIN BS or EN Standards.

4.9.1.2 ALUMINUM WALL CAPPING

Aluminum wall capping shall conform to ASTM B 209 M, DIN 18339, BS or EN Standards.

4.9.2 FLASHING

Flashing shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations. Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be installed on top of joint reinforcement. Lashing shall be formed to direct water to the outside of the system.

4.9.2.1 THROUGH-WALL FLASHING

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further in to the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

4.9.2.2 LINTEL FLASHING

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 50 mm, or shall be applied over top of masonry and pre-cast concrete lintels. Bed joints of lintels at joints shall be under laid with sheet metal bond breaker.

4.9.2.3 VALLEY FLASHING

Valley flashing shall be provided at intersections of roofs where a valley is formed. Flashing shall be a minimum of 500 mm centered on the valley (extending each direction a minimum of 250 mm). Valley flashing shall have a small ridge in the center to allow for expansion and contraction. Material shall be stainless steel, galvanized or match finished roofing metal.

4.9.2.4 SILL FLASHING

Sill flashing shall extend the full width of the sill and not less than 100 mm beyond ends of sill except at joint where the flashing shall be terminated at the end of the sill.

4.9.3 METAL FASCIA & SOFFIT

No wood fascias and/or soffits are allowed. Use metal fascias and soffits throughout. Extend roof decking out over fascia a minimum of 20 mm. Provide a 40 mm drip flashing over edge of roof decking so that it extends past bottom of decking on all sides of the building. Soffits shall be a minimum width of 600mm extending from the building wall.

4.9.4 CONTINUOUS SOFFIT VENT

Enclose soffits and return to vertical wall. Provide continuous soffit venting of all overhangs on the underside of the soffit. The opening shall be no larger than 100 mm and set in a minimum of 50 mm from the exterior fascia edge.

4.9.5 RIDGE VENT

For sloping roofs, provide continuous metal ridge vent at the top of roof along the ridge. Ridge vent shall be sized to provide adequate ventilation of the roofing system.

4.9.6 SCREEN

Provide insect screen for all soffit, ridge, vents, louvers and all openings except for doors and windows unless otherwise specified.

4.9.7 EXPANSION JOINT PROFILES

Metal expansion joints shall have a profile to allow deflection and expansion in two directions. Metal shall be treated for exterior conditions. Expansion joints shall be water proof.

4.9.8 ROOF GUTTERS

Roof gutters shall be installed as indicated. Roof gutters shall be rigidly attached to the building. Supports for roof gutters shall be spaced according to manufacturer's recommendations. A 600 mm overlap, jointing with approved crimping or welding shall provide a continuous gutter along the building eaves.

4.9.9 DOWNSPOUTS

Downspouts shall be designed and fabricated for each specific application. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing and shall not block the flow of water to the downspout for low sloped roofs. Downspouts shall be rigidly attached to the building with supports a minimum of 1.5 m apart. At the base of each downspout, concrete splash block shall be placed to eliminate damage to the building due to rain water runoff toward the building. In rural locations, a layer of rock 10 - 80 mm in size, 100 mm thick, may be substituted upon governmental approval.

4.9.10 WALL CAPPING

Wall Capping shall be installed according to the manufacturer's recommendations.

4.10 SEALANTS

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has

exceeded shelf life or has jelled and cannot be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. The Contractor shall tool smooth fresh sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints; apply sealant, and tool smooth as specified. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

4.10.1 INTERIOR SEALANT

ASTM C 834 or ASTM C 920, Type S or M, Grade NS, Class 12.5. Use NT, DIN, BS, or EN equal standards.

4.10.2 EXTERIOR SEALANT

For joints in vertical and horizontal surfaces, provide ASTM C 920, Type S or M, Grade NS, DIN, BS, or EN equal standards.

4.10.3 FLOOR JOINT SEALANT

(ASTM C 920) Type S or M, Grade P, class 25, use T

4.10.4 PRIMERS

Provide a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application. Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

4.10.5 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint. Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

4.10.6 BACKING

Backing shall be 25 to 33% oversize for closed cell and 40 to 50% oversize for open cell material, unless otherwise indicated.

4.10.7 SURFACE PREPARATION

Surfaces shall be clean, dry to the touch, and free from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

4.10.8 MASKING TAPE

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

4.10.9 BACKSTOPS

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified.

4.10.10 PROTECTION

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

4.10.10.1 FINAL CLEANING

Provide cleaning solvent type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

4.10.10.1.1 MASONRY AND OTHER POROUS SURFACES

Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.

4.10.10.1.2 METAL AND OTHER NON-POROUS SURFACES

Remove excess sealant with a solvent-moistened cloth.

4.11 LOUVERS

4.11.1 INTERIOR LOUVERS

SDI 111-C, Louvers shall be stationary sight-proof or lightproof type as required. Louvers for lightproof doors shall not transmit light. Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 0.90 mm thick steel and louver blades of a minimum 0.60 mm. Louvers for lightproof doors shall have minimum of 20 percent net-free opening. Sight-proof louvers shall be inverted "V" blade design with minimum 55 or inverted "Y" blade design with minimum 40 percent net-free opening.

4.11.2 EXTERIOR LOUVERS

Louvers shall be inverted "Y", "V" or "Z" type. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gage as door facings. Louvers shall have steel-framed insect screens secured to room side and readily removable. Provide aluminum wire cloth, 7 by 7 per 10 mm or 7 by 6 per 10 mm mesh, for insect screens.

4.12 WINDOWS, DOORS & GLAZING

4.12.1 WINDOWS

Windows shall be operable. Operable windows shall be slider or awning type. A window with blackout film on the inside shall be provided only for the laundry space.

4.12.1.1 WINDOW SECURITY BARS

Provide 20 mm diameter steel bars, 100 mm on center spacing. Provide frame and secure with fasteners a minimum of 100 mm deep.

4.12.1.2 MATERIALS

4.12.1.2.1 ALUMINUM EXTRUSIONS

Provide alloy and temper recommended by the window manufacturer for the strength, corrosion resistance, and application of required finish, meeting the DIN 1725 raw material requirements, but not less than 215 N/mm² ultimate tensile strength and not less than 1.5 mm thick at any location for main frame and sash members.

4.12.1.2.2 FASTENERS

Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.

4.12.1.2.3 REINFORCEMENT

Where fasteners screw-anchor into aluminum less than 3 mm thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard non-corrosive pressed-in splined grommet nuts.

4.12.1.2.4 EXPOSED FASTENERS

Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match the finish of the member or hardware being fastened, as appropriate.

4.12.1.2.5 ANCHORS, CLIPS, AND WINDOW ACCESSORIES

Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with the requirements of DIN 1748; provide sufficient strength to withstand design pressure indicated. As a minimum provide 3 anchors on each side of the frame.

4.12.1.2.6 COMPRESSION-TYPE GLAZING STRIPS AND WEATHERSTRIPPING

Unless otherwise indicated, and at the manufacturer's option, provide compressible stripping for glazing and weather stripping such as molded EPDM or neoprene gaskets.

4.12.1.2.7 SEALANT

For sealants required within fabricated window units, provide type recommended by the manufacturer for joint size and movement. Sealant shall remain permanently elastic non-shrinking, and non-migrating. Comply with Sealants of these specifications for selection and installation of sealants.

4.12.1.2.8 WIRE FABRIC INSECT SCREEN

Wire Fabric Insect Screen shall be permanently fixed to the exterior of operable windows.

4.12.1.3 HARDWARE

Provide the manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended. Provide at a minimum one locking device on the interior of each window. Any operable window over 2 square meters shall have two locking devices as a minimum.

4.12.1.4 FABRICATION

Provide aluminum windows with factory finish in all buildings as indicated in the design drawings. Window openings shall be provided with insect screening permanently fixed to the exterior. Provide a minimum of

3 anchors on each side of the frame into the adjoining structure. Provide weather stripping system for all exterior windows and doors.

4.12.1.5 METAL WINDOW SILLS

Galvanized metal window sills, 0.90 mm, shall be installed on the exterior of all windows. The metal window sills shall have a turn down of 50 mm over the exterior masonry and stucco. Metal sills shall extend from side to side of the masonry opening in a single piece. Extend the metal window sill a minimum of 20 mm under the bottom of the aluminum windows. Install masonry mortar as required for a smooth surface under the window sills. Sills shall slope a minimum of 6 mm to the exterior and not allow water to puddle.

4.12.1.6 FINISHES

Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting. Color shall be white meeting the requirements of DIN 50018

4.12.1.7 INSPECTION

Inspect openings before beginning installation. Verify that rough or masonry opening is correct and the sill plate is level. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

4.12.1.8 INSTALLATION

Comply with manufacturer's specifications and recommendations for installation of window units, hardware, operators, and other components of the work. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place. Set sill members and other members in a bed of compound or with joint fillers or gaskets, as shown, to provide weather tight construction. Refer to the Sealant sections for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the work.

4.12.1.9 ADJUSTING

Adjust operating sash and hardware to provide a tight fit at contact points and at weather stripping for smooth operation and a weather tight closure.

4.12.1.10 CLEANING

Clean aluminum surfaces promptly after installation of windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

4.12.2 DOORS

Fire rated door assemblies including hollow metal frame and hardware shall be provided as indicated in the design drawings. Rated doors and frames shall be tested and approved as an assembly and shall be provided by a single manufacturer/distributor. Hardware for fire rated door assemblies shall be labeled as appropriate for fire rated applications and shall be coordinated with door manufacturer. All exterior doors shall be heavy duty metal doors with metal frames. Interior door shall be hollow metal doors with hollow metal frames. Commercial duty lock sets and hardware shall be used on all doors. Hinges shall be the 5 knuckle type or equivalent. Provide door handles and locksets that can be locked with a key on all doors. All door locks shall have a thumb latch on inside of door such that no key is necessary to exit the room or building. Coordinate the final keying schedule with Contracting Officer prior to ordering lock sets. Generally each building should have 8 master keys fitting all locks, 8 sub-master keys fitting all exterior doors and 3 keys each for each interior door. Include 25% spare key blanks for the amount of keys

provided per building. Provide numbering system identifying key to associated room door. Provide weather stripping system for all exterior doors.

4.12.2.1 OVERHEAD DOORS

Overhead doors shall be sized as required. Doors shall be fabricated from interlocking cold-rolled slats, designed to withstand building wind loading and be installed with wind locks. Curtain door slats shall be continuous for the width of the door and steel interlocking flat-profile design. Standard steel slats shall be made of roll-formed steel 18 gauge steel, either primed & painted galvanized, stainless steel or anodized aluminum as provided by manufacture. Channel or curtain door guides shall be provided on each side of door. Overhead doors shall have a weather stripping bottom bar, head and jambs. Weather stripping and astragals shall be natural rubber or neoprene rubber. A manual pull chain shall be connected to the operation of the rolling door to provide open and close operation. A locking pin shall be provided on each jamb of the interior side of the door. Door shall have manufacturer's standard five pin tumbler locks, keyed. Coiling housing shall be mounted above all opening, on the interior side. For rated openings, a fusible link shall be provided on the most hazardous side. The coiling shutter shall also be rated and designed accordingly by the manufacture for the required fire rating. Hoods shall be fabricated from steel sheets with minimum yield strength of 227.5 MPa. Doors shall be counterbalanced by an adjustable, steel, helical torsion spring mounted around a steel shaft in a spring barrel and connected to the door curtain with the required barrel rings.

Counterbalance-barrel components shall be as follows:

- a. Spring barrels shall be hot-formed structural-quality carbon steel, welded or seamless pipe. Pipe shall be of sufficient diameter and wall thickness to limit deflection to a maximum of 1/360 of the span.
- b. Counterbalance springs shall be oil-tempered helical steel springs designed with a safety factor of 4. Springs shall be sized to counterbalance the weight of the curtain at any point of its travel, and shall be capable of being adjusted to counterbalance not less than 125% of the normal curtain load. Spring adjustment shall be arranged in such a way that the curtain need not be raised or lowered to secure the adjustment.
- c. Counterbalance shafts shall be case-hardened steel of the proper size to hold the fixed ends of the spring and carry the torsion load of the spring.
- d. Barrel plugs shall be fabricated from cast steel machined to fit the ends of the barrel. Plugs shall secure the ends of the spring to the barrel and the shaft.
- e. Barrel rings shall be fabricated from malleable iron of the proper in-volute shape to coil the curtain in a uniformly increasing diameter.
- f. Shaft bearings shall be factory sealed ball bearings of the proper size for load and shaft diameters.

Door operators shall consist of an endless steel hand chain, chain-pocket wheel and guard, and a geared reduction unit of at least a 3:1 ratio. Required pull for operation shall not exceed 16 kg. Chain hoists shall have a self-locking mechanism allowing the curtain to be stopped at any point in its upward/downward travel and to remain in that position until moved to the fully open or closed position. Hand chains shall be cadmium-plated alloy steel with a yield point of at least three times the required hand-chain pull. Pretreated zinc-coated steel sheets shall be given the manufacturer's standard prime coat and an enamel finish coat applied to the exterior face after forming.

After installation, doors, track, and operating equipment shall be examined and tested for general operation and weather against the specified wind pressure, and weather resistance. Doors that fail the required tests shall be adjusted and retested. Doors that have been adjusted and fail subsequent tests shall be removed and replaced with new doors at no additional cost.

4.12.2.2 STEEL DOORS

SDI A250.8, except as specified otherwise. Prepare doors to receive specified hardware. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 44.5 mm thick, unless otherwise indicated. Doors shall be constructed using heavy gauge steel with minimum thickness of 1.2 mm.

4.12.2.3 DOOR HARDWARE

Hardware doors shall be equipped with all required commercial quality hardware complying with applicable portions of ANSI/BHMA A156.1 through A156.24. Hardware on exterior doors shall be appropriately selected for that application, preferably fabricated from stainless steel or chrome plated non-ferrous materials to the greatest extent possible. +

4.12.2.4 FIRE AND SMOKE DOORS AND FRAMES

The requirements of NFPA 80 and NFPA 105 respectfully shall take precedence over details indicated or specified.

4.12.2.5 THRESHOLDS

All exterior doors (except Mech/Elect rooms) shall be provided with manufactured metal thresholds conforming to ANSI/BHMA A156.21. Doors at all wet areas with ceramic tile or terrazzo tile flooring shall be provided with solid marble thresholds with marble threshold set 13 mm above tile. Thresholds shall span continuously from jamb to jamb.

4.12.2.6 STANDARD STEEL FRAMES

SDI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

4.12.2.7 WELDED FRAMES

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

4.12.2.8 STOPS AND BEADS

Form stops and beads from 0.9 mm thick steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space the fasteners approximately 300 to 400 mm on centers. Miter molded shapes at corners. Use butt or miter square or rectangular beads at corners.

4.12.2.9 WEATHER-STRIPPING, INTEGRAL GASKET

Provide weather-stripping that is a standard cataloged product of a manufacturer regularly engaged in the manufacture of this specialized item. Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals. Weather stripping shall be looped neoprene, synthetic rubber gasket, or vinyl held in an extruded non-ferrous metal housing. Air leakage of weather stripped doors shall not exceed 0.003125 cubic meters per second of air per square meter of door area when tested in accordance with ASTM E 283.

4.12.2.10 ANCHORS

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, anchors not lighter than 1.2 mm thick.

4.12.2.10.1 WALL ANCHORS

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

4.12.2.10.2 FLOOR ANCHORS

Provide floor anchors drilled for 10 mm anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

4.12.2.11 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI A250.8 and ANSI A250.6. For additional requirements refer to BHMA A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI A250.8, as applicable. Punch door frames, with the exception of frames that will have weather-stripping or lightproof or soundproof gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

4.12.2.12 HINGES

Exterior hinges shall have non-removable pins and be satin-chrome steel or stainless steel; Grade 1 anti-friction or ball bearing; and 3 each of 115 mm x 115 mm per leaf up to 900 mm wide door 125 mm x 125 mm for doors 900 mm to 1,200 mm wide. Interior hinges shall be Grade 1; antifriction or ball bearing; and 3 each of 115 mm x 115 mm per leaf up to 900 mm wide door 125 mm x 125 mm for doors 900 mm to 1,200mm wide. Hinges for labeled fire doors must be either steel or stainless steel. Hinges shall conform to ANSI/BHMA A156.1 and A156.7.

4.12.2.13 LOCKSETS, LATCHETS, EXIT DEVICES, AND PUSH AND PULL PLATES

Exterior doors shall have mortise locks conforming to ANSI/BHMA A156.13 for metal doors. Emergency exit devices shall be Grade 1, flush mounted type. Interior doors shall have mortise locksets conforming to ANSI/BHMA A156.13, Series1000, Grade 1. All locks and latchsets shall be the product of the same manufacturer. Locksets, padlocks and latchsets shall be provided, as required, with lever handles on each side. Provide heavy duty hasp and locks at all fuel storage tanks.

4.12.2.14 CLOSERS

Closers shall be provided on all exterior doors and fire-rated doors. All exterior doors and interior doors that require security or privacy such as toilet room shall be provided with heavy-duty hydraulic closers. Closers shall conform to ANSI/BHMA A156.4, Grade 1. Closers shall be surface-mounted, modern type, with cover. Closer shall be adjustable type and have slow-down control to prevent door leaf from slamming to frame. Provide door silencers on all door frames provided with closers.

4.12.2.15 DOOR STOPS

Door Stops: Door stops shall be provided on all exterior and interior doors. Door stops shall comply with ANSI/BHMA A156.16 and shall be satin chrome on bronze, Grade 1.

4.12.2.16 KEYING SYSTEM & LOCK CYLINDERS

Provide locks for all doors. A Master key system shall be provided. Master key system shall include a separate & different key for each door with a master key provided to open any & all doors.

Cylinders: Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have six pins. Cylinders shall have key removable type cores. All locksets, exit devices, and padlocks shall accept same interchangeable cores.

4.12.2.17 FINISHES

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI A250.8, or paintable A25 galv-annealed steel without primer. Where coating is removed by welding, apply touchup of factory primer. Provide door finish colors as selected by the Contracting Officer from the color selection samples.

4.12.2.18 WATER-RESISTANT SEALER

Provide a water-resistant sealer compatible with the specified finish as approved and as recommended by the door manufacturer.

4.12.2.19 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. On wraparound frames for masonry partitions, provide a throat opening 3 mm larger than the actual masonry thickness. Design other frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

4.12.2.20 INSTALLATION

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a 2 mm minimum, 3 mm maximum clearance at sides and top, and a 5 mm minimum, 6 mm maximum clearance over thresholds. Provide 10 mm minimum, 11 mm maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 3 mm in 50 mm. Door warp shall not exceed 6 mm when measured in accordance with WDMA I.S. 1-A. Hang doors in accordance with clearances specified in SDI A250.8. After erection and glazing, clean and adjust hardware.

4.12.2.20.1 FRAMES

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

4.12.2.20.2 GROUTED FRAMES

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

4.12.2.21 PROTECTION AND CLEANING

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is completely removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat. Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

4.12.2.22 WEATHER STRIPPING

Install doors in strict accordance with the manufacturer's printed instructions and details. Weather strip

the exterior swing-type doors at sills, heads and jambs to provide weather tight installation. Apply weather stripping at sills to bottom rails of doors and hold in place with a brass or bronze plate. Apply weather stripping to door frames at jambs and head. Shape weather stripping at sills to suit the threshold. Insert gasket in groove after frame is finish painted.

4.12.2.23 PRE-FITTING

At the Contractor's option, doors may be provided factory pre-fit. Doors shall be sized and machined at the factory by the door manufacturer in accordance with the standards under which they are produced. The work shall include sizing, beveled edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules as required to coordinate the work.

4.12.3 GLAZING

All glazing shall be double laminated and insulating. Laminated glazing shall be constructed of two panes of minimum 3 mm annealed glass laminated to a minimum 0.75 mm polyvinyl-butylal (PVB) interlayer, in accordance with UFC 4-010-01. Two panes of laminated glazing shall be installed in each window with hermetically sealed 13 mm airspace between them. After installation of windows, the contractor shall install a minimum 3 mil tinted film (Scotch Shield Ultra Safety and Security Window Film or approved equal) to the inside face of the glazing in accordance with manufacturer's instructions.

4.12.3.1 TEMPERED GLAZING

Tempered glass shall be kind FT fully tempered flat type. Class 1 clear, condition A uncoated surface, Quality q3-glazing select, conforming to ASTM, DIN, BS or EN standards. Color shall be clear.

4.12.3.2 SEALANT

Sealant shall be elastomeric conforming to ASTM, DIN, BS, or EN standards. Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulation glass. Color of sealant shall be as selected from manufacturer's full range of standard colors by Contracting Officer.

4.12.3.3 GLAZING GASKETS

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners.

4.12.3.4 FIXED GLAZING GASKETS

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM, DIN, BS or EN standards.

4.12.3.5 WEDGE GLAZING GASKETS

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM, DIN, BS, or EN standards.

4.12.3.6 PUTTY AND GLAZING COMPOUND

Glazing compound shall conform to ASTM, DIN, BS, or EN standards for face-glazing metal sash. Putty shall be linseed oil type conforming to DIN, BS, or EN standards for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

4.12.3.7 SETTING AND EDGE BLOCKING

Neoprene setting blocks shall be dense extruded type conforming to ASTM, DIN, BS, or EN standards. Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

4.12.3.8 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaced and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

4.12.3.9 INSTALLATION

Glass and glazing work shall be performed in accordance with, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

4.12.3.10 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

4.12.3.11 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth, or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

4.13 FINISHES

All exterior metal surfaces, including container exterior shall be painted to match existing adjacent buildings. Provide color boards with all materials, paints and finishes for COR approval prior to ordering materials. Color boards shall remain on site in view or with the Contractor until completion of the facility.

4.13.1 PAINTS & COATINGS

Paints and coatings shall be provided as a Specification 09 90 00 Paints and Coatings.

4.13.2 CONCRETE HARDENER

Concrete sealers shall be a liquid chemical sealer-hardener compound. Apply a minimum of two coats. Sealer shall be compatible with climate temperatures and not reduce the adhesion of resilient flooring, tile, paint, roofing, waterproofing or other materials applied to the concrete.

4.13.3 PAINT

Paint shall be oil based or latex. A primer shall be placed prior to any coats of paint. A minimum of two (2) coats of paint shall be used for each surface. Existing painted material shall be cleaned, cracks patched, and prepared for new paint. Existing sealant shall be inspected, cleaned or removed and new sealant placed.

4.13.3.1 EXPOSED EXTERIOR STEEL

Exposed exterior steel shall include items such as trim, frames, door, pipe rails and other exposed steel surfaces. Paint with one coat oil-based primer, with 2 coats of oil-based alkyd gloss enamel, color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.13.4 EXPANSION JOINTS IN PLASTER & STUCCO

All buildings utilizing stucco over insulation shall have control joints utilizing the following rules: Control Joints – Control (expansion and contraction) joints shall be installed in walls to delineate areas not more than 13.4SM (144SF). The distance between control joints shall not exceed 5.5M (18'-0" in either direction or length-to-width ratio of 2 ½ to 1. In addition, a control joint shall be located a 25MM (1'-0") from the corners of the building. See ASTMs C926, C1063, and C 1328. Illustrate location of control joints on all building elevations for the project. If stucco is directly applied to masonry or cast-in-place concrete, control joints shall be located at control joints in the back up construction and where the different materials meet. Utilize the same ASTM's for interior plaster and provide a control joint at the locations where there is a change of material or a building expansion or control joint.

4.13.5 EXTERIOR WALLS

The exterior of all buildings shall be stucco and/or plaster conforming to ASTM C926. A temperature of between 4 and 27 degrees C shall exist for a period of not less than 48 hours prior to application of plaster and for a period of at least 48 hours after plaster has set. Control joints shall be designed for expansion and contraction of plaster work due to thermal exposure. Control joints shall comprise of back to back casing beads. Install new stucco in 2 coats. The first coat shall be a scratch coat approximately 10 mm thick. Allow 7 days to cure. The second coat shall be finish stucco, smooth finish, approximately 10 mm thick. Allow 7 days to cure before painting. Stucco showing over sanding, cracks, blisters, pits, checks, discoloration or other defects is not acceptable. Defective plaster work shall be removed and replaced with new plaster at the expense of the Contractor. Patching of defective work will be permitted only when approved by the Contracting Officer. Patching shall match existing adjacent work in texture and color. All exterior color finish shall be integral with the stucco finish. No painted stucco shall be permitted due to minimize future maintenance.

4.13.6 INTERIOR WALLS

4.13.6.1 PLASTER WALLS

Interior walls shall be plaster applied in a similar manner as exterior stucco. Paint with 2 coats of semi-gloss off-white with less than 0.06% lead by weight color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.13.6.2 SOUND CONTROL

Walls between sleeping rooms shall have a Sound Transmission Class (STC) minimum 45-55 or better, An STC value is a single number rating used to characterize the sound insulating value of a partition (wall, floor, or ceiling). All walls shall be caulked at floor and ceiling prior to installing wall base. All openings between rooms shall be caulked or sealed. Doors shall have rubber seal around frames and threshold.

4.13.6.3 HARDEN INTERIOR WALLS

IMPORTANT: INTERIOR WALL STRUCTURE SHALL BE CMU (MIN THICKNESS = 100 mm). Interior walls shall be plaster applied in a similar manner as exterior stucco. Paint with 2 coats of flat off-white paint with less than 0.06% lead by weight color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.13.7 INTERIOR CEILINGS

4.13.7.1 CONCRETE CEILINGS

Concrete ceilings shall be exposed concrete painted with 2 coats of flat white, with less than 0.06% lead by weight.

4.14 TILE WORK

Tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C and rising. Temperature shall be maintained above 10 degrees C while the work is being performed and for at least 7 days after completion of work. Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a non-corrosive soap or other approved method of protection.

Floors in wet areas shall be 300 mm x 300 mm terrazzo tile with thin set mortar. Joints shall be 2-3 mm. Waterproof gray grout shall be applied the full depth of the tile. Floors shall slope, minimum 1/50, to floor drains. Slope shall be obtained with sloping mortar bed of minimum 20 mm thickness. Provide continuous waterproofing membrane beneath sloping mortar bed, turn up wall 300 mm behind wall base. Membrane shall be fully sealed at joints and shall shed water into body of floor drain. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

Floors in administration areas, living quarters, corridors, and all rooms unless otherwise stated in the standard drawings shall be sealed concrete. Joints shall be 2-3 mm. Waterproof gray grout shall be applied the full depth of the tile. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

Walls in wet areas shall be tiled with 150 mm x 150 mm glazed ceramic tile up to 2000 mm above the floor to include interior of toilet stalls, showers and behind sinks. Joints shall be 2-3 mm. Waterproof gray grout shall be applied full depth of the tile. Grout shall cure for 72 hours and then be sealed with a commercial grout sealant in two coats. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

The ablution drain areas shall be recessed below the floor level 200 mm and lined with ceramic tile. Ceramic tile shall extend up the wall past the water spigots to a height of 2000 mm above finished floor. Seats shall be formed concrete with terrazzo tile finish to match the floor, 300 mm x 300 mm x 300 mm high finished dimensions. Color of ceramic tile shall be selected by the Contracting Officer from samples provided by the Contractor. Spacing between tiles shall be similar to terrazzo tile.

4.15 SPECIALTIES

4.15.1 MIRRORS

600 mm x 900 mm, 6 mm plate glass shall be mounted above all lavatories. Mount bottom of mirrors 1100 mm above finished floor.

4.15.2 TOILET PAPER HOLDERS

Toilet paper holders with removable pin shall be stainless steel, installed approximately 200 mm above floor by eastern toilets and 600 mm above floor by western toilets.

4.15.3 SHOWER CURTAIN RODS & SHOWER CURTAIN

Shower curtain rods, stainless steel, heavy duty, 1.20 mm shall be mounted between the walls of each shower stall. Mount rod 2000 mm above finished floor. Provide a shower curtain with support rings for each shower stall.

4.15.4 GRAB-BARS

Stainless steel grab-bars, heavy duty, 1.20 mm, two each 900 mm and 1050 mm long, 40 mm diameter shall be mounted behind and beside all eastern toilets, and bathtubs as they occur. Mount grab-bars between 610mm - 900 mm height on the walls. Each bar shall support no less than 91 Kg in any direction.

4.15.5 PAPER TOWEL DISPENSERS

Paper towel dispensers, 0.683 mm Type 304 stainless steel, surface mounted. Furnish tumbler key lock locking mechanism.

4.15.6 LIGHT DUTY METAL SHELF

Provide a 600 mm long x 150 mm wide, light duty stainless steel shelf with integral brackets over each lavatory and laundry sink.

4.15.7 ROBE HOOKS

Provide a minimum of two robe hooks on all toilet and shower stalls.

4.15.8 KITCHEN CABINETRY

Pre-manufactured kitchen cabinetry, with base counters and overhead cabinets are required in the kitchen room. Spaces shall be made for disposal and a double basin sink. Space shall be provided for a refrigerator/ freezer unit & utilities to support. Counter top shall be constructed from durable material as approved by Contracting Officer. Cabinetry shall be stain and cut resistant with approval from the Contracting Officer.

4.15.9 CLOTHESLINES

Fabricate clothes line assembly in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling imitations. Clearly mark units for reassembly and coordinated installation. Wire-rope assemblies (clothes line cable) shall minimize the amount of turnbuckle take-up used for dimensional adjustment so the maximum amount is available for tensioning wire ropes. Wire rope shall be nylon covered. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of ~1 mm, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces. Form work true to line and level with accurate angles and surfaces. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Cut, reinforce drill, and tap as indicated to receive finish hardware, screws, and similar items. Welded connections: cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

4.16 FACILITY TYPES

All facility types shall be constructed according to the standard designs unless otherwise noted.

4.16.1 DINING FACILITIES

4.16.1.1 CEILING FINISH

Ceilings of Dining Facility shall be exposed concrete painted with 2 coats of flat white, with less than 0.06% lead by weight.

4.16.1.2 IRON COOK TOP

Provide iron cook top in kitchen minimum thickness of 50 mm. Provide circular cut outs per the standard drawings. Provide steel infill plates for all cut out openings. Cook top can be made of several pieces for ease of handling. Adjacent plates shall be tight fitting to each other.

4.17 SOLID-FUEL WOOD BURNING HEATING STOVES

Commercial grade wood burning stoves shall be free standing and constructed and installed in accordance with NFPA-221 and the ICC-IFC and the standard drawings. Stoves shall not be located closer than 3.0 m from any exit and 1.0 m from any wall. Stoves shall be primed and painted with black heat-resistant paint.

Covered wood storage areas shall be provided next to the building and shall be secured and surrounded with chain link fencing to prevent pilfering. Gates with lockable latches shall be provided as part of the security (occupant to provide paddle locks).

4.17.1.1 PASS-THROUGH COUNTER TOP

Provide 1.6 mm stainless steel pass through counter tops at openings between the kitchen and dining area. Edges shall be turned down 30 mm and corners shall be welded and ground smooth. Provide anchor angles welded to the bottom of the counters to anchor tops to masonry walls below. Provide a minimum of six (6) anchors on the Dish Return Counter, three (3) on each side of the wall. Provide a minimum of eight (8) anchors on the Serving Counter, four (4) on each side of the wall. Anchor angles to wall with masonry expansion sleeves and stainless steel screws. Counter tops are to be 600 mm wide x length of opening shown. Counter height is 1000 mm above floor finish (AFF).

4.17.1.2 FIRE COUNTER SHUTTER (DINING FACILITIES)

Fire Counter Shutters shall be installed in conjunction with the Pass-Through Counter Tops described in the paragraph above. Fire counter shutters shall be used to separate the kitchens from the dining areas, and shall be U.L labeled for gypsum board, masonry and steel openings, and rated at 90 minutes in full compliance with NFPA-80 standards. Finish of shutter, guides and hoods shall be stainless steel. System shall be activated by 74° C fusible links, and by electrical switches located near exit doors. Bottom bar sliding bolt locks shall be provided to secure the shutters in the down position; bolts shall be operated from the kitchen side of the shutter.

5.0 MECHANICAL

5.1 GENERAL

The work covered by this section consists of design, supply, fabrication, and installation of new building heating, ventilation and air-conditioning (HVAC) systems. It also includes the delivery to site, erection, setting to work, adjusting, testing, balancing and handing over in perfect operating and running condition all of the HVAC equipment including all necessary associated mechanical works. HVAC equipment will normally consist of split-pack heat pump units with supplemental electric heating elements, industrial quality unit heaters, air ventilation systems and specialized industrial ventilation systems.

5.2 SPECIALIST SUB-CONTRACTORS QUALIFICATIONS

The HVAC works shall be executed by a heating and cooling specialist sub-contractor experienced in the design and construction HVAC equipment to include conventional refrigerant systems, heat pump units, space heaters and knowledge in fabricating specialized units consisting of supplemental electric resistance heaters in satisfying the specified indoor design conditions.

5.3 STANDARD PRODUCTS

All materials and equipment shall be standard product of a manufacturer regularly engaged in the manufacture of the product and shall duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

5.4 CODES, STANDARDS, AND REGULATIONS

The design and installation of equipment, materials, and work covered under the mechanical services shall conform to the standards, codes, and regulations provide in the paragraph, List Of Codes And Technical Criteria, where applicable except where otherwise indicated under particular clause(s). The publications to be taken into consideration shall be those of the most recent editions. Standards other than those mentioned may be accepted provided that the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall submit proof of equivalency if requested by the Contracting Officer.

5.5 EQUIPMENT PROTECTION

Provide exterior pad-mounted mechanical equipment with either protective fences and concrete-filled steel bollards or protective screen walls to prevent accumulation of debris and vandalism.

5.6 DESIGN CONDITIONS

All mechanical and plumbing equipment and systems to be designed to comply with seismic criteria and parameters identified in Section 01015, Paragraph 3.6.

Outside Design Conditions (Contractor shall verify the ambient conditions with available and reliable local weather data).

Contractor shall use the below weather date for equipment compatibility with the site conditions.

Tarin Kowt Area:

Summer: 41 C (106 F) Dry Bulb (DB) & 21.7 C (71 F)] Wet Bulb (WB)

Winter: -1.7 C (29 F)

Daily Range: 12 C (21 F)

5.6.1 INDOOR DESIGN CONDITIONS

Facility Type	Summer Temperature	Winter Temperature
Battalion HQs	Cooling 25 C (78 F)	Heating 20 C (68 F)
Officers Barracks	No Cooling	Heating 20 C (68 F)
Enlisted Barracks	No Cooling	Heating 20 C (68 F)
NCO Barracks	No Cooling	Heating 20 C (68 F)
Large Latrine	No Cooling	Heating 20 C (68 F)
Small Latrine	No Cooling	Heating 20 C (68 F)
Training Building	No Cooling	Heating 20 C (68 F)

Medical Clinic	Cooling 25 C (78 F)	Heating 20 C (68 F)
Battalion Storage Building	No Cooling	Heating 20 C (68 F)
Small DFACs	No Cooling	Heating 20 C (68 F)
Vehicle Maintenance Building	No Cooling	Heating 20 C (68 F)
POL Building	No Cooling	No Heating
Fuel Operators Building	No Cooling	Heating 20 C (68 F)
Small Arms Storage	No Cooling	Heating 20 C (68 F)

Warehouses, laundry, and storage buildings and vehicle maintenance bays shall be provided with ventilation to maintain the indoor conditions to 10 F above the summer ambient DB temperature. If the warehouse is to be occupied (people working), provide infrared heaters to spot heat the space where the people normally work. Vehicle maintenance bays shall be provided with infrared heaters or unit heaters.

5.6.2 NOISE LEVEL

Noise levels inside occupied spaces generated by HVAC systems indoors shall not exceed NC 35. Noise levels for outdoor generators are provided in paragraph: MECHANICAL REQUIREMENTS FOR GENERATORS.

5.6.3 INTERNAL LOADS

Occupancy: Use ASHRAE standards to calculate sensible and latent heat from people. In general, light/moderate office work is 73 Watts sensible and 45 Watts latent.

Lighting: 21.5 W/sq.m maximum (however lighting levels shall meet minimum requirements and shall be accounted for in the heating and cooling loads based on the actual lighting design).

Outdoor Air: Outdoor ventilation air shall be provided per ASHRAE Standard 62.1. In general this requires 2.5 lps/person plus 0.3 lps per sq.m of floor space; outdoor air requirements can be satisfied by windows that open to the outside.

Toilet/Shower Exhaust: 85 cmh per toilet, urinal, and shower head. At extreme cold in winter this value can be reduced for short periods to 40 cmh per toilet-shower to conserve heat. Provide two-speed fans.

Ablution Exhaust: 35 cmh/sq.m. At extreme cold in winter this value can be reduced for short periods to 10 cmh/sq.m to conserve heat. Provide two-speed fans.

Building Pressurization: 1.3 mm W.G.; maintain negative pressure in latrine areas. This is only applicable for buildings provided with central ducted forced air systems

5.7 AIR COOLING & HEATING EQUIPMENT

Environmental control of the facilities shall be achieved by HVAC equipment as listed below and approved by the U.S. Government. Unless otherwise noted, the Contractor may choose any combination of equipment to achieve the inside design conditions specified for the floor plans that is the most Life Cycle Cost Effective to the government. Contractor shall size and select equipment based on equipment manufacturer's performance data at the project site elevation and temperature conditions and ensure the equipment's performance meets the design heating and cooling sizing requirements.

Facility Type	Type of HVAC System	Remarks
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Battalion HQs	Packaged or Split-Pack Heat Pump Units Per Section 01010	Provide Unit Heaters, Ceiling Fans, & Adequate Ventilation For All Other Rooms
Officers Barracks	Unit Heaters	Provide Adequate Ventilation & Ceiling Fans
Enlisted Barracks	Unit Heaters to Include the Smaller Storage Areas	Provide Adequate Ventilation & Ceiling Fans
NCO Barracks	Unit Heaters	Provide Adequate Ventilation & Ceiling Fans
Large Latrines	Unit Heaters	Provide Adequate Ventilation & Exhaust
Small Latrines	Unit Heaters	Provide Adequate Ventilation & Exhaust
Training Buildings	Unit Heaters	Provide Adequate Ventilation & Ceiling Fans
Medical Clinic	Packaged or Split-Pack Heat Pump Units Per Section 01010	Provide Unit Heaters, Ceiling Fans, & Adequate Ventilation For All Other Rooms
Battalion Storage Buildings	Unit Heaters for Satellite Offices Only	Provide Adequate Mechanical Ventilation For All Storage Areas
Vehicle Maintenance Buildings	Unit Heaters Or Infrared Heaters	Provide Adequate Ventilation For All Areas With Overhead Vehicle Tailpipe & Battery Room Exhaust Systems
POL Storage Buildings	No Heaters	Provide Adequate Ventilation & Exhaust
Fuel Operator's Buildings	Unit Heaters	Provide Adequate Ventilation & Ceiling Fans
Small Arms Storage Building	Unit Heaters	Provide Adequate Ventilation & Ceiling Fans
Guard Towers	Unit Heaters	Provide Adequate Ventilation
Guard Shacks	Unit Heaters	Provide Adequate Ventilation

5.7.1 UNITARY (DUCTLESS SPLIT-PACK) HEAT PUMP UNITS

Unitary ductless split-pack heat pump units shall be provided for rooms as dictated in Section 01010. Ductless split units shall be unitary in design and factory manufactured ready for installation. Heat pump units shall provide cooling during summer and heating during winter. Heat pump units shall be suitable for low ambient operation. Interior evaporator fan coil units shall consist of a DX coil, blower, and washable filter all mounted in a housing finished for exposed installation. Cooling coil condensate piping shall route to and discharge to the sanitary sewer system. The exterior condensing units shall contain compressor, condenser coil, and all controls/fittings enclosed in a weatherized housing. Outdoor condensing unit shall be wall-mounted on steel supports or on a concrete pad. Copper refrigerant suction and liquid piping shall be sized, insulated and installed in accordance to unit manufacture recommendations. Unit temperature control shall include wall-mounted adjustable thermostat, blower on-off-auto switch and heating-cooling change over control.

5.7.2 WALL PENETRATIONS

Building wall penetrations for fans, exhaust duct, vents, and louvers shall be carefully made so as not to deteriorate the structural integrity of the wall system. The Contractor shall consult with the building manufacturer, if possible, to determine the best way to penetrate the walls. The Contractor is encouraged to locate exterior wall louvers above doors, whenever possible, to take advantage of the structural framing void located above doors. If the building manufacturer is not available, the Contracting Officer shall be consulted. In either case, the recommendations of the manufacturer and/or Contracting Officer shall be strictly adhered to.

5.7.3 WALL TRANSFER GRILLES

Wall penetrations for air transfer between two spaces shall be provided with a factory fabricated grille on both the inlet and outlet sides of the opening. For fire-rated walls in accordance with NFPA-90A with air transfer penetrations, fire dampers shall be installed between the inlet and outlet grilles.

5.7.4 OUTSIDE AIR INTAKE, MAKEUP, AND EXHAUST LOUVERS

Outside air louvers shall be factory fabricated of steel or aluminum and allow the specified air quantity into the space intended. Louvers shall be square or rectangular with rain-proof exterior face blades and internal grille. To reduce sand and dirt migration, outside air intakes shall be installed as high as possible within architectural constraints or a minimum of 1.5 m above the ground. Consideration shall be given to locating the louvers near the heating and cooling unit and encourage air flow across the room in conjunction with the exhaust fan. Outside air intake louvers shall be provided with air filter (See Air Filtration), insect screen, and motorized dampers interlocked to open when the laboratory exhaust fan operates. Minimum louver dimensions shall be 300 mm x 300 mm.

5.7.5 AIR FILTRATION

All supply air shall be filtered using manufacturer's standard washable filters mounted inside the unit. In addition, all outdoor makeup air intakes shall be equipped with 50 mm thick washable filters.

5.7.6 CONTROL WIRING AND PROTECTION DEVICES

Control wiring and protection of the air conditioning units being offered must be the manufacturer's standard, pre-wired, installed in the unit at the factory or as recommended. Thermostats shall be located near the unit return, and shall include lockable housing that allows viewing of settings without permitting access. For units serving more than one (1) area, the thermostat shall be located near the return of the space with the highest heat generation.

5.8 COLD STORAGE ROOMS

5.8.1 SHOP DRAWINGS

Contractor shall provide the Contracting Officer shop drawings for approval of appropriately sized walk-in refrigerator and freezer to include proposed manufacturer, construction details, manufacturer's instructions, evacuation and charging procedures, operation and maintenance date, start-up and initial operational tests.

5.8.2 MODULAR CONSTRUCTION

Walk-in coolers shall be panel type modular construction. Doors shall be swing type. Refrigeration equipment shall be remote located on the exterior of the building. Provide a temperature/ alarm system. Provide interior lighting with exterior switch. Floors of cool rooms shall be insulated panelized construction from the manufacturer of the cool rooms. The concrete floor will not be depressed.

Walk-in freezer shall be able to maintain the product temperature between -10 to 0 deg F.

Walls, ceiling and flooring of the coolers and freezer shall not contain any wood or wooden material. Walls and ceiling shall be made of sandwiched panels filled with polystyrene or urethane insulation material. Panels shall be aluminum or stainless steel.

Ramps shall be provided at the door of the cooler and freezers.

5.8.3 PIPING

Refrigeration piping shall be annealed or hard drawn seamless copper tubing in conformance with ASTM B280. Refrigeration systems shall be remote type.

5.8.4 ELECTRICAL

Electrical characteristics shall match local power 380v/3ph/50Hz and 220v/1ph/50Hz.

5.8.5 PACKING MATERIAL

Preservation and packing shall be commercial grade.

5.8.6 TEMPERATURE RECORD & CONTROL

Provide a recording thermometer. Provide temperature alarm with connector to remote temperature alarm.

5.8.7 OUTDOOR CONDENSING UNIT

Provide outdoor condensing unit cover and security fence or wall to protect outside units. Provide condensing unit outdoor controls for operation down to –18 degrees C ambient temperature.

5.8.8 REFRIGERATION EQUIPMENT

Refrigeration equipment shall be designed for remote installation. Design units for 16 to 18 hour operation at the indicated interior temperature in –18 degree C ambient temperature. Capacities, air delivery, and dimensions shall be as indicated. Remote condensing units shall be factory fabricated and rated in accordance with UL303 and ARI 365. Provide with motor, air cooled condenser, receiver, compressors, mounted on a common base. Compressors shall be hermetic type. Evaporators shall be factory fabricated and rated in accordance with UL 412 and ARI 420. Forced convection, unit cooler type, made to suspend from the ceiling panels, with forced air discharged parallel to the ceiling. Provide with air circulating motor, multi-fin tube type coil and grille assembled within a protective housing. Air circulation motors shall be lifetime sealed, and the entire unit-cooler assembly shall be accessible for cleaning. Provide a drip pan and drain connection. When the cold storage room is used for freezing, provide an automatic electric heat defrosting system. Provide a timer type defrost controllers.

5.8.9 DRAIN LINES

Provide condensate drain lines and drains below freezer floors with electric heating cable, thermostatically controlled to maintain 10 degrees C at zero flow rate. Cable shall be sized in accordance with manufacturer's recommendations.

5.8.10 INSTALLATION INSTRUCTIONS

Submit a copy of installation instructions to the Contracting Officer covering both assembly and installation of the refrigeration equipment prior to start of work

5.8.11 TESTING

Start up and initially operate the systems upon completion of the installation of the equipment and refrigerant piping. Adjust the safety and automatic controls to place them in operating sequence. The

Contractor shall record manufacturer's recommended readings hourly. Operational test shall cover a period of not less than 24 hours. Upon completion of Operational test the systems shall be performance tested. Test duration shall not be less than 8 hours. Test shall include the following information to be in the report with conclusions regarding the adequacy of the systems:

Time, dates and duration of tests:

- a. Inside dry-bulb and wet-bulb temperatures maintained in each room during the tests employing recording instruments calibrated before the tests.
- b. Outside dry-bulb and wet-bulb temperatures obtained from recording instruments calibrated and checked hourly with a sling psychrometer.
- c. Evaporator and condenser entering and leaving temperatures taken hourly with the compressors in operation.
- d. The make, model, and capacity of each evaporator and condensing unit.
- e. Voltmeter and ammeter readings for condensing units and evaporators.

5.8.12 OPERATIONS & MAINTENANCE

Provide chart showing the layout of the refrigeration systems, including piping, valves, wiring, and control mechanisms. Submit printed instructions covering the maintenance and operation of refrigeration equipment. Tag shutoff valves in accordance with the instructions. Provide any special tools necessary for repair and maintenance of the systems. Upon completion of the work and at a time designated by the Contracting Officer, provide instruction to designated personnel in the operation and maintenance of each refrigeration system. The period of instruction shall not be less than one 8-hour day.

5.8.13 CLEAN-UP

Remove any packing material. Wash and clean floors, walls, ceilings and equipment inside of cool rooms. Wash and clean exposed surfaces on outside.

5.9 VENTILATION AND EXHAUST SYSTEMS

All fans used for building ventilation, exhaust, and pressurization shall be selected for minimum noise level generation. All fans used for supply or roof/wall exhaust, including toilets, showers, and ablutions, shall be **centrifugal** forward curved, backward inclined, or airfoil fans with non-overloading characteristics of high efficiency and quiet running design. The fans shall be of the heavy-duty type with durable construction and proved performance in a desert environment. Each wall exhaust fan shall be provided with motorized or gravity dampers which close automatically when the fan is not running. Each ventilation or intake air fan shall be provided with an interlocked motorized damper which closes automatically when the fan is not running and shall be sized for and provided with filter and insect screen. Also, each fan shall be complete with vibration isolator, external lubricators, and all accessories and sound attenuators as necessary.

Consideration shall be given to wall-mounted fans (except for batter rooms) to reduce roof penetrations and possibility for water leaks (especially for metal roofs).

Intake or makeup air openings ventilation and for exhaust fans shall be provided with motorized dampers which are interlocked with the exhaust fans and provided with air filters and insect screens. The motorized dampers shall open or close when the ventilation or exhaust fan is on or off respectively. Louvered intake openings, or ventilation or exhaust fan system, shall be sized for a maximum static pressure (SP) drop (that includes filter resistance) of 25 Pa to prevent excessive negative pressurization of the building. **Exterior louvers located in doors (i.e. Door Louvers) are not permitted except under special circumstances.**

Maintenance shops and similar spaces that use solvents and oils shall be provided with mechanical exhaust air systems. Intake or makeup air openings for an exhaust fan system shall be provided as indicated above. The exhaust systems shall consist of a fan, ductwork, exhaust grills, and interlock controls. Design shall be in compliance with the latest addition of the Industrial Ventilation UFC 3-410-04N or ACGIH Industrial Ventilation manual.

To reduce sand and dirt migration, outside air intakes shall be installed as high as possible within architectural constraints or a minimum of 1.5 m above the ground.

5.9.1 EXHAUST SYSTEMS FOR WOOD FIRED STOVES

Each stove shall be designed to be vented separately to the outside air. Two (2) or more stoves connected to one (1) chimney shall not be permitted. Each stove shall be equipped with a manually adjustable inlet (or combustion air) damper and an outlet (or vent or chimney) damper. Vent or chimney shall be constructed of black steel with a minimum thickness of not less than 1.5 mm. The chimney shall be routed inside the building heated envelope to allow vent gases to cool as close to room temperature as possible before expelled outside.

The chimney shall rise at least 60 cm above any roof surfaces within a 3 meter radius of the chimney so the top clears any obstacles to wind flow needed to produce a stable draft. Outside vent or chimney shall be provided with rain cap.

The vent or chimney diameter shall be a minimum of 200 mm so vent gases are kept warm and flow quickly through the system. The stove and venting system shall be reasonably sealed to prevent leaks that introduce cool air and make the system more vulnerable to adverse pressures. The chimney, supports, and rain cap shall be primed and painted with black heat-resistant paint. Contractor must submit shop drawings for approval.

5.9.2 KITCHEN HOOD EXHAUST AND MAKE-UP AIR

Kitchen hood exhaust and make-up air system shall be provided as required and comply with ASHRAE Handbook- HVAC Applications, NFPA 96, SMACNA, and as per Kitchen design specialist and equipment supplier requirements. Makeup air and exhaust systems for each hood shall be independent of other duct systems. Residential kitchen ventilation hoods shall not be used. Kitchen exhaust hoods shall be design for Type I (grease smoke and provided with filters) and constructed from minimum 1.0 mm stainless steel material. Exhaust flow rate shall be a minimum of 2,230 cmh per linear meter of hood open-side length. All surfaces shall be designed to be easily and thoroughly cleanable. Hoods shall extend a minimum of 225 mm beyond the front edge of the stove and shall be installed a maximum of 1,200 mm above the surface of the stove. Hoods shall be sealed to the rear wall. The center hood of each bank of fans shall have one electrical switch on the front face to operate the exhaust and make-up air fans. Grease filters will not be required. Hoods shall be constructed so that grease filters can be installed at a later date. Hoods shall be provided with a side panel at each end to close in the area between the stove and the hood. Side panels shall be the width of the hood and shall extend to the rear wall at 45 degrees. Approximate dimensions are 925 mm by 925 mm by 45 degrees. If a non-combustible wall abuts a stove, then a side panel shall not be required on that side of the hood.

The air velocity in the exhaust duct shall be not be less than 4 mps but limited to 7.6 mps. All exhaust duct joints and seams shall be continuously welded or brazed. Joints, seams, and penetrations shall be externally welded or brazed to form a watertight seal with a smooth surface that is readily cleanable. Ductwork shall be protected against corrosion. Ducts shall be constructed of 18-gauge stainless steel. Supply and exhaust systems for each hood shall be independent of other duct systems.

Bracing and supports shall be constructed of non-combustible material securely fastened to the structure. Bolts, screws, rivets, and other fasteners shall not penetrate the duct walls. Ducts shall be placed a minimum of 450 mm from combustible material or 75 mm non-combustible structures. Ductwork terminating through the roof shall extend a minimum of 450 mm above the roof. Where roof terminations are not possible, ducts may be terminated through an exterior wall. All ductwork terminating through an exterior wall shall be located a minimum of 900 mm from exterior openings. Ductwork shall be pitched to drain from back to hood. All ductwork terminations shall be a minimum of 3 m horizontally from other buildings and property lines.

Roof-mounted centrifugal exhaust fans shall be the upblast type. Exhaust fans shall be centrifugal and fan motors located outside the airstream. Fan discharge shall not impinge on the roof, other equipment or appliances, or parts of the building. Discharge outlet of exhaust fans shall be a minimum of 1,000 mm above the roof. Up-blast fans shall be hinged and supplied with a flexible weatherproof electrical cable to

permit inspection and cleaning. Connection between ductwork and exhaust fan shall be flanged, gasketed, and bolted. Each exhaust fan shall be electrically interlocked with its corresponding makeup air fan to prevent system operation without both fans in service.

The Designer shall take special note that multiple large LPG stoves will be installed in the kitchen. Note: Many of the local Afghan cooks are accustomed to standing on top of the stoves in order to stir the large cauldrons of food. This common cooking practice should be taken into consideration when designing the exhaust hood height. The height of the hood above the stovetop should be such that a man of average stature could stand upright without risk of hitting their head on the hood.

Make up air intake shall be integral with the hood system or be located as close to the exhaust intake to prevent cold drafts. Non-integral makeup air shall be tempered to within 6 C of room design temperature. The outside air capacity shall be 85% to 90% of the exhaust capacity to ensure the kitchen area is under negative pressure. Return air balance, 10-15%, shall be pulled from the dining area through the kitchen. In general, makeup air shall be enough to prevent kitchen negative pressures from exceeding 5.0 Pa. Make-up air inlet locations shall take into consideration the prevailing wind direction and shall be placed upstream of exhaust outlets. Wherever possible, makeup air inlets shall be located a minimum of 3,000 mm from exhaust outlets. Where make-up air inlets are located within 3,000 mm of an exhaust outlet, the make-up air inlet shall be located a minimum of 920 mm below the exhaust outlet. Each make-up air fan shall be electrically interlocked with its corresponding exhaust air fan to prevent system operation without both fans in service.

Provide general kitchen exhaust system for the food preparation and serving areas in accordance with ASHRAE Standard 62.1. The general kitchen exhaust system shall electrical interlock and cease operation when the main kitchen hood exhaust system is in operation.

To reduce sand and dirt migration, outside air intakes shall be located as high as possible within architectural constraints. The intakes shall be sized so that free air velocities are below 2.5 mps. For inhabited buildings, locate all air intakes (from center-line of intake) at least 1.5 m above the ground. Each air intake shall be provided with a motorized damper which is interlocked with the exhaust fan(s).

5.9.3 BATTERY ROOM EXHAUST

Battery room exhaust shall comply with UFC 3-520-05. The exhaust fan for the lead acid shop shall be sized to maintain concentrations of hydrogen gas in the battery room to below 1.0 percent concentration. The exhaust fan shall be sized larger when required for mechanical ventilation cooling. The fan shall have a non-sparking wheel and the motor shall be located out of the airstream. Any components such as fan and ductwork in contact with the exhaust air shall be constructed out of fiberglass reinforced plastic (FRP) or polyvinyl chloride (PVC). The ventilation system for the shop shall be designed to provide a negative static pressure by exhausting 10% more air than is supplied. Supply air for the shop shall be 100% outside air.

5.10 ELECTRIC HEATERS

Electric heat trace cable for freeze protection shall not be provided as a substitute for space heating system.

5.10.1 UNIT HEATER

Electric resistance unit heaters shall be installed in spaces where only heating is required. Generally, unit heaters shall be mounted as high as possible. Unit heaters shall be of the industrial grade, durable, and securely fastened to the ceiling, wall or structure. Electric heating unit shall be self-contained, suspended from ceiling or structure provided with heating elements and fan with at least two (2) speeds. Unit shall be provide control-circuit terminals and single source of power supply with disconnect. Heating wire element shall be nickel chromium. Limit controls shall be provided for overheat protection. A hard-wired tamper resistant integral thermostat shall be generally located under the unit or in the return air flow stream.

5.10.2 OVERHEAD DOOR CONTROL DEVICES

Control switch and wiring shall be provided to activate when the overhead doors open. The switch shall override the space thermostat and deactivate the space heating equipment. Minimum set point temperature to override the heating deactivation switch during door-open periods shall be 4 C. After the doors are closed, the room thermostat should assume control.

5.11 TEST ON COMPLETION

Upon completion of the work, the Contractor shall demonstrate to the Contracting Officer that the installation is adjusted and regulated correctly to fulfill the function for which it has been designed. The Contractor shall test, adjust, balance and regulate the section or sections of concern as necessary until the required conditions are obtained. Operational test shall be conducted once during the winter and once during the summer. Contractor shall coordinate with the Contracting Officer on when the test shall be scheduled. Tests shall include all interlocks, safety cutouts, and other protective devices to ensure correct functioning. All such tests shall be carried out with full written records of the values obtained and the final settings and submitted to the Contracting Officer in writing.

The following tests and readings shall be made by the Contractor in the presence of the Contracting Officer and all results shall be recorded and submitted in a tabulated form.

- a. Ambient DB and WB temperatures
1. Room Inside Conditions:
 - A. Inside room DB & WB temperatures
 - B. Air flow supply, return and/or exhaust
 - C. Plot all temperatures on psychrometric chart
- b. Air Handling Equipment: Air quantities shall be obtained by anemometer readings and all necessary adjustments shall be made to obtain the specified quantities of air indicated at each inlet and outlet.
 1. Following readings shall be made:
 - A. Supply, return and outside air cmh (cfm) supplied by each air conditioning system.
 - B. Total cmh exhausted by each exhaust fan
 - C. Motor speed, fan speed and input ampere reading for each fan
 - D. Supply, return and outside air temperature for each air-conditioning system.
 2. Electric Motors: For each motor:
 - A. Speed in RPM
 - B. Amperes for each phase
 - C. Power input in KW

5.12 ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

Note that electrical requirements for all HVAC systems shall be designed and installed to operate on the secondary power standard required herein. The existing power distribution system may require modifications or upgrades to support the additional power required by the HVAC unit. The Contractor is responsible to field verify all the conditions and provide complete shop drawings showing any incidental power upgrades. All electrical work shall comply with the National Electric Code.

All thermostats shall be wall-mounted as indicated on the drawings. In lieu of a thermostat, a temperature sensor may be located in the same location or in the return duct and connected to a thermostat located

near the unit return. Wall-mounted thermostats shall be mounted 1.5 m (5') above the finished floor and be easily accessible. Thermostats for the latrine facilities shall be located near the unit return and mounted 1.5 m (5') above the finished floor. Operation of the control system shall be at the manufacturer's standard voltage for the unit.

The following are the minimum requirements for motors regarding enclosure, insulation and protection:

- a. Compressor Hermetic: Provide inherent (internal) overload protection.
- b. Condenser: Provide internal thermal overload protection.
- c. Evaporator (Open Class "A") fan motor type provides internal thermal overload protection.

5.13 MECHANICAL REQUIREMENTS FOR GENERATORS

The following shall be provided in the Mechanical design and installation for **Prime** stationary generator sets and related mechanical systems with their interface with the facility. This includes, but not limited to, the following:

- a. Foundations,
- b. Mountings,
- c. Exhaust systems,
- d. Cooling systems,
- e. Ventilation,
- f. Noise attenuation,
- g. Equipment configuration.

See Electrical Section for power and electrical equipment requirements, and Plumbing Section for fuel system requirements.

The generator set(s) shall be the manufacturer's design for outdoor weatherproof installation with skid-mounted radiator. Weatherproof generator set(s) shall be protected from the elements with a structural cover which extends over the bulk fuel storage tank(s) as indicated.

Heating devices for the generator set engine coolant and starter batteries shall be provided as per manufacturer's recommendation for cold starting. Ambient temperature and elevation derating calculations shall be clearly shown in the design analysis (DA).

Generator noise levels shall be based on the location and operating at 100% load. For continuous day-nighttime operation in a residential area (i.e. Barracks, etc.), 45 dB(A) shall be the maximum noise level outside the nearest residential building. For continuous day-nighttime operation in a non-residential area (i.e. Workshops, Offices, etc.), 60 dB(A) shall be the maximum noise level outside the nearest occupied building. All generator sets shall be provided with the manufacturer's factory installed sound attenuation enclosure cabinets, the manufacturer's integral muffler system, vibration isolators, as a minimum, to reduce noise.

Exterior exhaust system shall be with minimal backpressure, directed to disperse the noise away from people and occupied buildings, and located near the radiator air discharge.

For fuel and day tank requirements, see Plumbing paragraph, "GENERATOR FUEL STORAGE/DISTRIBUTION."

For fire emergencies, see Fire Protection paragraph, "PORTABLE FIRE EXTINGUISHERS."

Generator set facilities shall be oriented with the prevailing winds (with the alternator upwind) to assist ventilation air flow across the alternator and engine and promote heat removal by the fan and radiator. All generator sets with skid-mounted radiators and installed in an enclosed building shall have the ventilation air drawn directly from the outside and discharged directly to the outside. All non-weatherproof generator sets shall be installed in a totally enclosed building with intake and exhaust

louvers fitted with bird screens. When non-weatherproof generator set(s) are classified as "standby," inlet and outlet louvers shall be provided with motorized dampers that open automatically when a generator comes online. **All weather-proof generator sets and fuel storage tanks shall be provided with a covered (roof-only) shelter enclosed with a chain link security fence.**

For all indoor and/or ducted generator sets, air flow calculations for static pressure (SP) shall be provided in the design analysis (DA) for all indoor and/or ducted generator sets. Calculations shall clearly state the following information located in the manufacturer's specifications:

- a. Minimum air flow through the radiator.
- b. Minimum engine combustion air flow.
- c. Maximum SP allowable by the radiator fan.

Actual SP calculations shall include and clearly show the SP drop across any louvers, bird screens, dampers in the open position, duct transitions, and any equipment that restricts air flow.

For generator set testing, see Electrical. For fuel system requirements, see Plumbing.

5.14 MEDICAL WASTE INCINERATORS

A medical waste incinerator shall be provided in quantities and capacities as required in Section 01010 and specifically designed by the manufacturer to dispose of all Bio-Hazard medical wastes. The unit shall have the following specifications:

- An eight (8) square meter chain-link fence enclosure with a metal roof for collecting materials at the incinerator station shall be provided.
- A Perimeter fence around the incinerator and collection area, 2m in height with triple-strand razor wire on top and a locking personnel gate shall be provided.
- The Contractor shall include site delivery, construction, calibrating and testing of the incinerator in the bid price.
- At a minimum the unit shall be sized to incinerate 2.0 kg/exam-room/24-hrs when being operated continuously for 12 hours per day, but no less than 100kg/day total.
- The Incinerator shall be manually batch fed.
- The incinerator shall be installed and commissioned in full operating condition at the end of the project. The incinerator refractory shall also be fully cured and at temperature at time of turn over to the user.
- The contractor shall provide training to appropriate ANA staff according to the 'Operations and Maintenance for Mechanical' paragraph in this section.
- The incinerator shall be located directly adjacent to the medical clinic and the contractor shall allow for adequate vehicle maneuvering space around the Incinerators fuel tank.
- The incinerator fuel tank shall meet the following requirements:
 - The tank shall be installed above ground and according to all of the fuel tank requirements in Section 1015 including secondary containment.
 - The tank shall be sized to hold a 14 day supply of diesel fuel
 - The tank shall be under a metal canopy structure to keep rain water out of the secondary containment sump

The following capacity calculations and all supporting information shall be provided in the design analysis (DA) for the incinerator:

- The daily waste stream rate (kg/day or lbs/day)
- Minimum incinerator burn rate capacities
- Minimum cure time for the refractory to prevent cracking to the refractory
- A complete list of the maintenance parts
- A minimum of 500 lbs of refractory for repairs
- A minimum of 1 gallon of hydraulic oil

5.15 OPERATIONS AND MAINTENANCE (O&M) FOR MECHANICAL

Contractor is required to provide a 12-month supply of parts for operation and maintenance of equipment according to the manufacturer's recommendations. In addition to this, the Contractor shall provide an inventory of all items, location/address stored and secured, and commissioning plans.

The O&M manuals must be provided prior to any training activities. Manuals shall be "tri-lingual" in Dari, Pashto and English.

All control panels shall have tri-lingual name plates in Dari, Pashto and English.

The Contractor shall provide an outline of the training lesson plan (to be approved by the Government) prior to conducting training. CD recordings of training on video shall also be provided, after training is conducted.

6.0 PLUMBING

6.1 GENERAL

The Contractor shall design and build domestic cold and hot water systems, waste, drain and vent systems, waste-oil collection and storage and fuel-oil storage and distribution systems required in the facilities identified in Section 01010 Scope of Work and as described herein. The Contractor shall also be responsible for complete design and construction of all domestic and special plumbing systems required for full and safe operations in the Generator Plant, Water Storage and other facility or structures required in this contract.

The work covered in this scope also includes the delivery to site, erection, setting to work, adjusting, testing and balancing and handing over in full operating condition all of the plumbing equipment and associated plumbing works.

6.2 SUB-CONTRACTORS QUALIFICATIONS

The plumbing systems shall be executed by a plumbing specialist subcontractor experienced in the design and construction of these types of systems.

6.3 STANDARD PRODUCTS

All materials and equipment shall be standard product of a manufacturer regularly engaged in the manufacture of the product and shall duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

6.4 CODES, STANDARDS, AND REGULATIONS

The design and installation of equipment, materials and work covered under the plumbing services shall conform to the standards, codes, and regulations provide in the paragraph, List of Codes and Technical Criteria, where applicable except where otherwise indicated under particular clause(s). The publications to be taken into consideration shall be those of the most recent editions. Standards other than those mentioned may be accepted provided that the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall submit proof of equivalency if requested by the Contracting Officer.

6.5 EQUIPMENT PROTECTION

Provide exterior pad-mounted plumbing equipment in addition to fences and bollards or screen walls, provide designed overhead canopies/shelters for exterior electrical generators and adjacent fuel tanks. Overhead canopy height shall be a minimum of 2 m above the highest point of the engine cabinets and fuel tanks.

6.6 PLUMBING SYSTEM REQUIREMENTS

6.6.1 WATER

Domestic cold and hot water shall be provided in the facilities to serve the water usage and plumbing fixtures provided for the facility. Water service to each facility shall enter the building in a mechanical, toilet, storage, or similar type space. The building service line shall be provided with a shut off valve installed either outside in a valve pit or inside the mechanical room or similar spaces. Water piping shall not be installed in or under the concrete foundation except for the service line. All water piping shall be routed parallel to the building lines and concealed in all finished areas. Insulation shall be provided where required to control sweating of pipes or to provide protection from freezing. Electric heat trace cable for freeze protection shall not be provided as a substitute for space heating systems.

6.6.2 PIPING MATERIALS

Domestic cold water shall be distributed by means of standard weight schedule 40 galvanized steel pipe, Polyvinyl Vinyl Chloride (PVC) or Polyethylene (PE) (ASTM D 2737) plastic piping. Domestic hot water shall be distributed by means of standard weight schedule 40 galvanized steel pipe, or Chlorinated Polyvinyl Vinyl Chloride (CPVC) piping. Domestic water joints shall be connected using either solvent cement or mechanical threads.

Waste and vent piping can be made of either galvanized steel pipe (schedule 40) or Polyvinyl Vinyl Chloride (PVC) conforming to ASTM D 2665.

Corrosion protection shall be provided if galvanized piping comes in contact with earth or masonry floors, walls or ceilings. The Contractor shall attempt to route all piping beyond the grasp of the occupants. **All exposed domestic water, waste, and vent piping shall be schedule 40 galvanized steel flush mounted; wall mounting brackets for exposed domestic water, waste, and vent piping shall be spaced a maximum of 40 cm apart to minimize vandalism.** Polypropylene (PP) pipe is NOT allowed as a substitute because connections, many times, are made using the fusio-therm technique which requires special training and maintenance equipment for installation and repair.

6.6.3 PLUMBING WATER FIXTURES

The following typical plumbing fixtures shall be provided:

- a. Eastern Water Closet with flush tank assembly. Provide acid resisting fired porcelain enameled cast iron water closet complete with rotating No-Hub 'P' trap and No-Hub coupling to meet piping requirements. Eastern Style water closet shall be furnished with integral non-skid foot pads and bowl wash down non-splashing flushing rim. The water closet shall be completely self supporting requiring no external mounting hardware and shall be flush with floor. The Eastern Style water closet shall incorporate waterproofing membrane flashing flange. Provide a cold water spigot/hose bib, only 300 mm above finished floor on the right (from a perspective of standing inside of the cubicle and looking out) sidewall of the cubicle. Toilets shall be oriented north and south; toilets shall not face east or west. Plastic toilet water tanks will not be installed.
- b. Lavatories. All sinks shall be the trough-type constructed of block and concrete with ceramic tile exterior and lining capable of withstanding abuse. Provide maintenance access to waste piping and P-traps from under the sink. Trough-type sink faucets shall be similar to service sink faucets with one-piece brass body construction, fixed short integral spout, hot and cold water manual mixing valves, and capabilities for withstanding abuse. Lavatories inside prisoner cells shall be tamper-proof with integral spout, soap depression, and outlet connection to slip 40 mm OD tubing.
- c. Sink Faucets. Faucets shall be ball valve or equivalent hose bib type with hot and cold water valves for manual mixing. **No goose neck faucet fixtures shall be used.**
- d. Service-Janitor's Sink. All janitor's sinks shall be floor mounted, enameled cast iron, and be provided with copper alloy rim guard. Provide hot and cold water valves with manual mixing. Faucet handles shall be ball valve or equivalent hose bib type chrome plated brass or bronze

- alloy. Service sinks provided in maintenance areas shall be concrete. Service sinks in battery rooms shall be acid resistant. Include a stainless steel shelf and three (3) mop holders with janitor sinks.
- e. Shower. Showerhead and faucet handles shall be chrome plated brass or bronze alloy. Provide hot and cold water valves for manual mixing. In addition to a shower head, provide each shower stall with a threaded faucet approximately 1.2 m AFF with hot and cold-water controls, mixing valve, and diverter valve so water can be directed to either the shower or to the lower faucet. Shower shall be provided with low flow shower head. The shower head shall be heavy duty type and securely fastened to the wall. Hand-held shower head with flexible shall be allowed. Shower stalls shall be no less than 2 m x 1.5 m and shall have a solid door on the outside. Showers shall contain a single mixing valve for hot and cold water mixing and a wall-mounted shower head.
 - f. Eye Wash Assembly. Provide eye wash assembly in facilities where lead-acid batteries exist and where appropriate. Provide a floor drain in the area if appropriate (i.e. Non-freezing locations, etc.).
 - g. Kitchen Sink. Single bowl sink shall be corrosion resisting formed stainless steel. Faucet bodies and spout shall be chrome plated brass or bronze alloy. Handles, drain assembly, and stopper shall be corrosion resisting steel or brass/bronze alloy.
 - h. Ablution Trench. See building floor plans for size and construction of trench and number of stations. Provide trench drain with brass grating and strainer. Provide each station with hot and cold water valves with manual mixing. Faucet handles shall be copper alloy.
 - i. Grease Interceptor (Exterior only). Shall be steel construction manual cleaning type with removable checker-plate cover complete with flow control valve. Tested and rated in accordance with PDI G-101. Concrete shall have a minimum compressive strength of 21 MPa in 28 days (kitchen use only).
 - j. Floor Sink. Provide floor sink, circular or square, with 300 mm overall width or diameter and 250 mm nominal overall depth. They shall have acid resistant enamel interior with cast iron body, aluminum sediment bucket and perforated grate of cast iron. Outlet size as indicated on plans.
 - k. Floor or Shower Drain: Cast iron construction with galvanized body, integral seepage pan, and adjustable perforated or slotted chromium plated bronze, nickel-bronze, or nickel brass strainer consisting of a grate and threaded collar. Toilet room floor drains are similar except are provided with built-in, solid, hinged grate.
 - l. Trench Drains: Floor trench shall be of concrete construction with a cast iron grate. The cast iron grate shall be sectionalized and hinged so that it can easily be opened to clean out the trench. Iron grates shall be fabricated in sections in length not greater than 1,500 mm. The floor trench shall be provided with perforated aluminum pan inserts which can be removed to clean out large food particles. The floor trench drain shall be adjustable perforated or slotted chromium plated bronze, nickel-bronze, or nickel brass strainer consisting of a grate and threaded collar. This style of floor trench shall be installed in the kitchen area of the DFACs in response to kitchen cleaning practices of the local national staff.
 - m. Room hose bibs and floor drains shall be provided as required. Afghan dining facility kitchen area clean-up hose bib to be supplied with connecting hose on reel including approximately 12 m of hose. Provide clean-up spray nozzle with hose assembly.
 - n. Provide P-Traps per IPC for all fixture drains, floor and trench drains, and shower drains. P-traps shall have minimum of 50 mm water seal.
 - o. Large Pot sink, provide clean-up spray nozzle with hose assembly.

6.7 HOT WATER

Hot water shall be provided for the facility to supply 50 C (120 F) hot water to fixtures and outlets requiring heated water. Water of a higher temperature, 60 C (140 F) and above, shall be provided for special uses or processes as in kitchens (except hand wash lavatories) and for sterilization. All hot water piping shall be insulated. A hot water re-circulating pump shall be provided if hot water piping run exceeds 30 m (100) in accordance with the IPC.

6.7.1 WATER HEATERS

The hot water shall be generated by electric water heaters (WH). All WHs shall be factory insulated. Each water heater shall be equipped with a vacuum relief valve and temperature and pressure (T&P) relief valve that discharge into a nearby floor drain; discharge piping shall terminate 50 mm (2") above the floor drain. The larger floor-mounted units shall be located inside mechanical rooms, storage rooms, janitor rooms, or similar type spaces. Smaller wall-mounted units may be located in toilet-lavatory areas for single remote water closets. Multiple water heaters (two or more) shall be of equal size and connected by common inlet and outlet manifolds in a "**reverse return**" configuration to ensure equal flow and drawdown rates. All floor-mounted WHs shall be elevated on a 100 mm (4") raised concrete pads. In cases where the pressure of the water system violates the manufacturer's recommendations, a pressure reducer shall be installed in the line before the water heater.

Water heater storage capacity (liters) and recovery capacity elements (kW or liters per hour) shall be sized in accordance with ASHRAE Fundamentals Handbook-HVAC Applications, "Service Water Heating," as follows:

"Industrial Plant""Hotel""Office Building". The unit(s) capacities shall be for commercially available tank and electric heating element gas burner sizes.

Facility Type	Type of Building Criteria For Calculating Hot Water Demand	Remarks
Battalion HQs	"Office Building"	
Admin Buildings	"Office Building"	
Armament Maintenance Facility	"Office Building"	
Officers Barracks	"Hotel"	
NCO Barracks	No Water Heaters	No Showers or Lavatories
Combination NCO & Enlisted Barracks	No Water Heaters	No Showers or Lavatories
Enlisted Barracks	No Water Heaters	No Showers or Lavatories
Large Latrines	"Hotel"	Each Ablution Shall be Treated as a "Service Sink" and Laundry Station Shall be Treated as a "Laundry, Stationary Tub" for Calculations
Small Latrines	"Hotel"	Each Ablution Shall be Treated as a "Service Sink" and Laundry Station Shall be Treated as a "Laundry, Stationary Tub" for Calculations
Large DFACs (Not included in this project.)	"Hotel"	Provide Low Temperature for Handwashing Lavatories & High Temperature for Kitchen Uses
Battalion Storage Buildings	No Water Heaters	No Showers or Lavatories
Vehicle Maintenance Buildings	"Hotel"	

Training Buildings	No Water Heaters	No Showers or Lavatories
Classroom Buildings	No Water Heaters	No Showers or Lavatories
Ammunition Supply Point Facilities	No Water Heaters	No Showers or Lavatories

6.8 WASTE, DRAIN, & VENT SYSTEMS

Every trap and trapped fixture shall be vented in accordance with the IPC. In order to minimize vent piping, incorporate either "Circuit Venting," "Combination Drain & Vent," or "Wet Venting" options systems in accordance with the IPC.

6.8.1 DESIGN & INSTALLATION CONSIDERATIONS

The Designer and installer shall have in mind a vent option (i.e. Fixture Venting, Circuit Venting, Wet Venting, etc.) before designing the route of the waste line(s) in a building in order to comply and avoid inconsistencies with the IPC. **Under no circumstances shall VENT PIPING be routed horizontally under the floor due to blockages over time.** Every dry vent connection shall rise up vertically from the waste pipe no less than 45-degrees with the horizontal (Note: In most cases, the connection will be 90 degrees for the horizontal or straight up. See IPC). Every dry vent shall rise up vertically at least 15 cm (6") above the flood level rim, of the fixture being vented, before going horizontally.

6.8.2 FLOOR DRAINS

Floor drains shall be provided in each room that contains a water source. Floor drains shall be provided in the mechanical equipment and toilet/shower/ablution rooms. Floor drains shall be provided next to water heaters. In mechanical rooms, floor drains shall be provided to avoid running drain piping long distances above or over the floor. Drain outlet shall use a P-trap system to trap sewer gases and shall be a one-piece system without removable parts.

This style of floor trench shall be installed due to the kitchen washdown cleaning practices of the local national staff.

6.8.3 CLEANOUTS

Cleanouts shall be provided no more than 8 m (25') apart when measured from the upstream entrance of the cleanout.

6.9 WASTE, DRAIN, AND VENT SYSTEM

6.9.1 GENERAL

Every trap and trapped fixture shall be vented in accordance with the IPC. In order to minimize vent piping, incorporate either "Circuit Venting," "Combination Drain & Vent," or "Wet Venting" options systems in accordance with the IPC.

6.9.2 DESIGN CONSIDERATIONS

The Designer shall have in mind a vent option (i.e. Fixture Venting, Circuit Venting, Wet Venting, etc.) before designing the route of the waste line(s) in a building in order to comply and avoid inconsistencies with the IPC. **Under no circumstances shall vent lines be routed horizontally under the floor due to blockages over time.** Every dry vent connection shall rise up vertically from the waste pipe no less than 45 degrees with the horizontal (Note: In most cases, the connection will be 90 degrees for the horizontal or straight up. See IPC). Every dry vent shall rise up vertically at least 15 cm above the flood level rim, of the fixture being vented, before going horizontally.

6.9.3 FLOOR DRAINS

Floor drains shall be provided in each room that contains a water source. Floor drains shall be provided in the mechanical equipment and toilet/shower/ablution rooms. Floor drains shall be provided next to water heaters. In mechanical rooms, floor drains shall be provided to avoid running drain piping long distances above or over the floor. Drain outlet shall use a P-trap system to trap sewer gases and shall be a one-piece system without removable parts. Trench drain shall be provided for the DFAC kitchen areas.

6.9.4 CLEANOUTS

Cleanouts shall be provided no more than 8 m apart when measured from the upstream entrance of the cleanout.

6.10 SPECIAL PLUMBING SYSTEMS

Contractor shall design and construct compressor air storage and distribution, waste-oil collection and storage, fuel-oil storage and distribution and other plumbing systems that are required for full performance of equipment and operations and for maintenance in the Power Plant and Vehicle Maintenance facilities. These systems shall be designed and built in accordance with codes and publications referenced herein before and in compliance with equipment manufacturer recommendations.

6.10.1 PLUMBING FOR BATTERY ROOMS

Plumbing features for battery room shall comply with requirements in Part 6 of UFC 4-229-01N. Plumbing shall be provided as follows:

- a. Acid-resistant and alkali-resistant floor drains shall be provided in the lead acid and NICAD shops, respectively.
- b. Emergency shower and eyewash facilities shall be provided and be located within 16 m of the battery handling areas.
- c. Fiberglass holding tank (underground or above-ground) shall be provided for waste electrolyte. Underground tank shall be located in a concrete containment pit with removable waterproof cover. Above-ground tank shall be located on concrete slab with concrete berm around perimeter which provides containment' equal to tank volume plus 10 percent. Tank shall be located to provide gravity drainage from dump sinks. A float type level indicator, pump out connection, and vent on holding tank shall be provided.
- d. Acid-resistant and alkali-resistant dump sinks shall be provided in the lead acid and NICAD shops, respectively. The sinks shall empty into a holding tank before disposal. Caution shall be exercised when separately pouring acid or alkaline waste. Acid and alkaline waste shall never be poured together into the sinks.
- e. Facilities shall be provided with hose bib, garden hose, and rack for flushing and neutralizing spilled electrolytes for shop.

6.10.2 COMPRESSED AIR SYSTEMS

Compressed air system shall be in accordance with UFC 3-420-02FA. Compressed air shall be provided using a packaged air-cooled electric motor driven compressor and ASME rated receiver with air cooler and moisture separator to remove moisture and oil. Compressed air system shall be capable of operation up to 10 kPa maximum for 6 kPa normal units. High-pressure system (above 10 kPa) shall be provided to supply compressed air to equipment where required. Provide an engine driven air compressor where generator electrical power is unreliable. Noise level of air compressor should not exceed acceptable db limits.

The air distribution system shall be provided with necessary regulator valves to maintain desired pressure. Compressed air drops shall be provided in each maintenance bay, tire shop, tool room, paint shop and other areas requiring compressed air service. Where required, line filters, lubricators, and/or

hose reels shall be provided. Compressed air piping shall be black steel pipe and painted to match wall color.

6.10.3 WASTE/HAZARDOUS DRAINAGE

Waste or hazardous drainage from battery repair/charging areas shall be treated prior to entering the base general waste drainage system. Hazardous waste drainage piping shall be acid resistant. Smaller battery rooms shall have waste treatment available using an acid neutralizing tank.

Waste oil storage tanks shall be provided for collection of waste oil in the power plants and vehicle maintenance facilities. Waste oil storage tanks shall be underground and be with either double-wall fiberglass, double-wall steel with cathodic protection, or a concrete secondary containment vault with applied POL-resistant coating. Underground waste oil piping shall be provided with either double-wall fiberglass, double-wall steel with cathodic protection, or a concrete secondary containment trench with removal covers and applied POL-resistant sealant. The secondary containment vault shall be sized to contain 110% of the total waste oil in the tanks. Provisions should be made in the design of the underground storage tank that enable manual detection of leaks, prevent overfilling, facilitate liquid level detection, and allow for vapor release.

6.10.4 DRAINAGE FROM MAINTENANCE AREAS

Drainage from maintenance areas, fueling areas, POL areas, etc., shall be treated prior to entering the base general waste drainage system. Treatment shall consist of sand and oil separators as required by facility function. Buried oil storage tanks shall be provided where required.

6.11 JOINT FUEL STORAGE & DISTRIBUTION

6.11.1 FUEL OIL STORAGE AND CONTAINMENT

Fuel Oil Storage and Distribution system shall be provided to support the operation of diesel engine generator set(s) and tank(s) and to support the vehicles used at various locations. Tanks shall be protected from the weather by a structural cover as indicated with the Electrical paragraph, Generator Power System. Tank size for generators shall be based on the generator set(s) fuel consumption (without the backup generator set fuel consumption) at 75% of the total load for the minimum number of 30 days. Tank size for vehicle support shall be 50,000 liters of Diesel and 5,000 liters of MOGAS. Tank size for the communications room backup generator shall be 1,900 liters. Contractor shall provide all needed fuel for testing of generators. The tanks shall have a sight glass gauge for visual fuel level inspection. The sight glass shall be installed on the same end of the tank as the discharge connection. The sight glass shall be attached to the tanks by thread-o-lets; the welded connection to the tank shall have full penetration and continuous welds. The sight glass shall show the 15% fill level to 90% fill level. A plastic hose that is tied off at one end for a sight gauge is not allowed.

Bulk storage of fuels shall consist of above-ground horizontal steel tanks only with either double-walls or containment dike. **Under NO circumstances shall GALVANIZED tanks be provided for storage of fuel oil or diesel.** Tanks shall be installed in accordance with NFPA 37.

The containment dike(s) shall be sized to contain the entire contents of the tank plus 10 percent. The dike structure shall be constructed of reinforced concrete. If more than one (1) tank is sharing a containment dike, then the dike need only be sized for the capacity of the largest tank, plus 10 percent.

Bulk storage tanks shall be complete with fill tube and cap, suction tube, tank gauge, vent, and other fittings and appurtenances required for full and safe operation. Tanks shall be provided with support saddles, platform/stair and concrete pad. Tanks shall have overfill protection devices and remote overfill alarms.

Tanks of 3,880 to 45,400 liters capacity shall be provided with 760 mm diameter manways. Tanks larger than 45,400 liters shall be provided with 900 mm diameter manways. Tanks 3,800 liters and larger shall be provided with a minimum of one (1) tank manway to allow for internal tank access. Piping shall not

penetrate through access manways. Tank shall be provided with a combination cleanout and gauge connection.

Vent pipe sizing shall be not less than 32 mm nominal inside diameter. Vent shall be the rupture disc type calibrated to burst at 14 kPa pressure, and operate at 80 percent of burst setting. Tank shall be provided with an overfill alarm system. Tank shall be provided with two (2) stick gauges graduated in m and mm. Stick gauge shall be of wood and treated after graduating to prevent swelling or damage from the fuel being stored. Each storage tank shall be provided with an automatic analog reading gauge which is directly mounted to a tank's manway cover. Cathodic protection shall be provided for metal components in accordance with the manufacturer's recommendations. Storage tanks shall be handled with extreme care to prevent damage during placement and shall be installed in accordance with the manufacturer's installation instructions. External platform/ladder access to tank top (i.e. manhole) shall be installed on a concrete pad.

Tank linings (interior) for mild steel tank shells shall not be required on AES projects at this time; however, steel tank exteriors shall be primed and coated. Exterior surface preparation shall consist of abrasive blast cleaning according to SSPC-SP6, primed with a two-component zinc-rich aromatic polyurethane, at 2.5 to 3.5 mils DFT (dry film thickness), followed by an intermediate coat of polyamide epoxy, spray applied at 4.0 to 6.0 mils, and a finish coat of aliphatic acrylic polyurethane, spray-applied at 3.5 to 5.0 mils.

6.12 MOTOR POOL FUEL POINT (DISPENSING)

Separate dispensing units shall be provided for diesel and MOGAS. Each dispensing unit shall be equipped with dual nozzles, two (2) mechanical dispensing meters, and key control. Fuel dispensing unit shall be installed on an island such that two (2) vehicles can simultaneously fuel on either sides of the dispensing unit. Coordinate site design and route all contaminated drainage water from the fuel dispensing pad through an oil/water separator.

Fuel piping shall be black steel only for piping located above grade and either steel or fiberglass for underground; **rubber hoses shall not be allowed, except for fuel dispensers. Under NO circumstances shall GALVANIZED piping, fittings, valves, or other equipment be used for fuel oil or diesel conveyance.** Secondary containment for underground piping shall be provided with either double-wall fiberglass pipe, double-wall steel with cathodic protection, or steel or fiberglass pipe located in a concrete secondary containment trench with removal covers (traffic-rated as applicable) and applied POL-resistant coating. The contractor shall be required to demonstrate that the containment pipe is leak tight by conducting a 35 kPa (5 psi) operational air test on the double containment pipe. This air test is between the primary pipe the exterior containment pipe. Pressure gauges shall be located at both ends of the double containment pipes that shall show the test results and show any increase in interstitial pressure due to a primary pipe leak.

Additional technical requirements for the gravity fed dispensers:

There shall be a support located on the hose side of the fuel filter; the fuel filter shall not be the support connection for the hose at the fuel dispensing station. A full port ball valve shut off valve shall also be installed at the fuel dispensing station, between the pipe outlet and the filter.

A reconnectable break away connection with automatic shut off valve shall be installed in the hose between the nozzle and fuel filter. Install the breakaway connection per manufacturer recommendations.

There shall be a stand pipe at the fuel dispensing station to locate nozzle when not in use, at the bottom of the stand pipe there shall be a minimum of 5 gallons of storage to accept any small spills from the nozzle. The hose shall have a loop hanger such that the hose shall hang above the top of the dispensing station when not in use.

The contractor shall be required to demonstrate that the fuel dispensing station can flow fuel a maximum of 0.76 L/S (10GPM) with the storage tank is full and a minimum of 0.23 L/S (3 GPM) with the storage tank at 1/3 full. The test shall be conducted for one minute and shall be witnessed by a government appointed representative.

The fuel dispensing system will not be considered complete and acceptable until it meets all the above requirements and testing criteria.

6.12.1 FUEL DISTRIBUTION SYSTEM

The fuel dispensing system shall be designed to supply clean diesel fuel (DFM) and motor gasoline (MOGAS). The fuel dispensing system shall receive fuel from bulk storage tanks as mentioned in the 1010 and above. Both the DFM and MOGAS shall be transferred from the storage tanks to the dispensing station(s) by gravity, a transfer pump system shall not be used for this installation.

Fuel piping shall be black steel for piping above grade and either steel or fiberglass for underground; **rubber hoses shall not be allowed. Under NO circumstances shall GALVANIZED piping, fittings, valves, or other equipment be used for fuel oil or diesel conveyance.** Secondary containment for underground fuel piping shall be provided with either double-wall fiberglass, double-wall black steel inner and steel outer with cathodic protection, double-wall black steel inner and fiberglass outer, or either black steel or fiberglass piping located in a concrete secondary containment trench with applied POL-resistant coating and removable covers (traffic-rated as applicable). Piping shall be installed straight and true to bear evenly on supports. Piping shall be free of traps, not embedded in concrete or pavement, and drain toward the corresponding storage tank when elevation permits. Belowground nonmetallic pipe shall be installed in accordance with pipe manufacturer's instructions. Belowground piping shall be laid with a minimum pitch of 0.4 m per 100 m (0.4 percent slope). Follow the same testing requirements for double containment as discussed in section 6.12.

Due to the system being a gravity system, the additional technical requirements for the fuel distribution system are:

The bottom of storage tank shall be at least 60 inches above the finished slab elevation that the vehicles park on to re-fuel. There shall be full port ball valves shall be installed as shut off valves at the tank discharge and immediately before and after the double containment pipe. Install a calibrated ball valve after the storage tank shut off valve to control flow rate, if necessary.

The dike containment shall be continuous below slab for locations where the pipe is being routed underground or in a trench that is below slab. Seal pipe penetration with a sealant that is both compatible with the stored fuels and flame resistant.

6.12.2 FILLING SYSTEM

A fuel filling system shall be provided for unloading fuel from fuel tanker into individual bulk storage tanks comprising of truck pad(s), duplex fuel transfer pumps, piping manifold and valves. The system shall provide remote fuel level monitoring panels at the pad(s). Lockable containment box shall be provided to contain any spillage encountered during tank filling.

6.12.3 TANK/PIPE TESTING AND TURNOVER

A tightness test shall be performed on each storage tank and associated piping. The tank tests shall be performed prior to making piping connections. Tests shall be capable of detecting a 0.1 ml/s leak rate from any portion of the tank while accounting for effects of thermal expansion or contraction. Each storage tank shall be pressurized with air to 35 kPa and monitored for a drop in pressure over a two (2) hour period during which there shall be no drop in pressure in the tank greater than that allowed for pressure variations due to thermal effects. Following the tank tightness test(s), each storage tank shall be leak tested in accordance with the manufacturer's written test procedure if the manufacturer's test procedure is different from the tightness tests already performed. Also following the tank tightness test(s) all associated piping shall be tested using the same procedures stated for testing the tank(s), **At the vehicle fuel point the Contractor shall provide a full supply of fuel for EACH tank at the time of turnover to the Government.**

6.13 LPG COOKING STOVE

Cooking area shall be provided with canopy type exhaust only kitchen hoods and associated exhaust and makeup air fans. These exhaust hoods shall include baffle type aluminum filters to trap grease/oil. The exhaust fan sizing calculations should recognize the use of LPG/propane stoves in the kitchen. Sizing should accommodate all stoves running simultaneously. Additionally, the placement of the exhaust hood should allow enough clearance for an average sized male to stand on top of the stove platform unobstructed, for standing on the stove is common local cooking practice. The higher than average placement of the hood will require the extension of the hood lip further than normal to catch the majority of the smoke and adequately vent the area. LPG/propane tank shall be located out the DFAC, under a cover, and in the fenced storage yard.

6.13.1 COOKING STOVES/BURNERS

LPG/propane stoves shall be installed with consideration to ease of cooking operation and daily cleanup. The stoves shall be set into a formed concrete opening such that it can easily be removed for replacement, maintenance and cleaning.

Each LPG/propane stove shall be provided with three (3) burners. The stoves shall be of commercial quality and be capable of producing the highest heat output with all three (3) burners on. The center burner is low heat, center and middle burner is medium heat and all three burners is high heat. A shut off valve for each burner shall be provided at the face of the LPG/propane appliance.

6.13.2 GAS PIPING

The LPG/propane piping shall not be embedded in the concrete floor. Installation of the LPG/propane piping in concrete trenches is highly recommended. The piping may be surface mounted provided that it is not susceptible to damage or causes any safety hazards.

Piping from LPG/propane tanks to their respective LPG/propane stoves shall be of wrought iron per ASTM B36.10M or black steel, ASTM A53. The steel piping shall terminate in front of the LPG/propane stoves with a shut off valve and quick disconnect nipple. A stainless steel flexible hose (Gastite or equal) shall connect the LPG/propane fuel tanks and the LPG/propane stove to the steel piping per NFPA 58, Section 5.8.6. Each end of the flexible hose shall be provided with quick disconnect dielectric fittings.

Flexible rubber hoses are not allowed.

LPG/propane supply piping shall be installed in pipe sleeves wherever it penetrates the building and concrete platform. Piping may also be surface mounted provided it is not susceptible to damage or causes any safety hazards.

Piping that passes through the exterior wall and concrete cooking platforms shall be provided with pipe sleeves. Piping shall be installed such that it is accessible and can be replaced without demolishing the building components. Under no circumstances shall the piping be installed below the floor.

6.13.3 PROPANE FUEL STORAGE (45 KG BOTTLES)

LPG-propane storage tanks shall be located outside and exterior to the building in a storage yard.

The storage of fuels shall consist of individual 45 kg (100-pound) portable bottle tanks. For a 30-day supply of fuel, provide four (4) bottles per cook stove. **The Contractor shall provide all tanks filled with LPG/propane fuel at time of completion.**

Remote Storage Area: Stored filled and empty LPG/propane storage tanks shall be installed on a concrete pad and placed within a covered, secure, enclosure located a minimum of 8.0 m (26') from any occupied building. Portable bottle tanks shall be secured with chains to prevent tipping, and have caps on all bottles. Chain link enclosure with two (2) walkways and four (4) rows of tanks is recommended for ready access and easy securing of the bottles. Enclosed buildings are discouraged due to the potential for the buildup of propane in the event of a leak. Chain link fences with a visibility barrier are acceptable if the visibility barrier allows minimally impeded airflow.

Connected Storage: Connected Portable Tanks shall be located outdoors near or adjacent to the building behind a fire rated exterior wall. Tank area shall have a cover and be located in a chain link secured enclosure. One (1) tank per stove will be allowed in this location, with all tanks manifolded together (For facilities with three (3) or fewer stoves, the stoves may be individually piped.). The tanks shall be complete with fill fittings, tank gauge, vent, 2-stage and line regulators, and other fittings and appurtenances required for full and safe operation. Portable bottle tanks shall be secured with chains to prevent tipping.

6.14 TESTING AND COMMISSIONING

The Contractor shall test all piping systems in accordance with IPC International Plumbing Code. The final test shall include a pressure test for all piping. After completing the work, the Contractor shall demonstrate that all piping systems operate to fully satisfy the function for which these systems have been designed. The Contractor shall test, adjust, balance and regulate the system and its controls as necessary until the required designed conditions are met. The Contractor shall include tests for interlocks, safety cutouts and other protective devices to demonstrate safe operation. All such tests shall be carried out in the presence of the Government and full written records of the test data and final settings shall be submitted to the Contracting Officer. After all tests are complete, the entire domestic hot and cold water distribution system shall be disinfected. The system shall not be accepted until satisfactory bacteriological results have been obtained.

7.0 FIRE PROTECTION

7.1 PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers shall be provided inside all facilities and at exterior locations as required in accordance with NFPA 10. Generally, extinguishers will be of the multi-purpose dry chemical type except for occupancies requiring a special type extinguisher (e.g., carbon dioxide portable fire extinguishers for electrical rooms). Fire extinguishers shall be located in an accessible location, free from blocking by storage and equipment, near room exits that provide an escape route. The top of the extinguisher shall not be more than 1.5m above the floor and not less than 101mm above the floor. The extinguisher shall be easy to each and placed where it will not be damaged.

8.0 ELECTRICAL

8.1 GENERAL

Contractor shall design and construct all electrical systems for the facilities to be provided. This includes design, construction, all necessary labor, equipment, and material for a fully functional system.

8.2 ELECTRICAL WORKERS QUALIFICATIONS

Electrical work shall be performed by qualified persons with verifiable credentials who are thoroughly knowledgeable with applicable code requirements. Verifiable credentials consist of a certificate of graduations from an approved trade school and required amount of experience, depending on work being performed, and should be identified in the proposal that is submitted. A qualified person is one who has received training in and has demonstrated skills and knowledge in the construction and operation of electrical equipment and installations and the hazards involved. This includes the skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment, to determine the nominal voltage of exposed live parts, the clearance distances and corresponding voltages to which the qualified person will be exposed.

8.2.1 SUPERVISORY ELECTRICIAN

Supervisory electricians must be graduates of an approved trade school, and must have two years of relevant electrician experience. Approved programs include but are not limited to the Afghanistan Technical and Vocational Institute (in Kabul), the Kunar Trades Training Center, and the Commercial

Technical Training Center (in Jalalabad). Work experience resumes and graduation certificates shall be submitted and approved prior to commencement of any design or construction involving electrical work. Approval is granted by the Contracting Officer's Representative with guidance by the Quality Assurance Branch and/or the Safety Office of the U.S. Army Corps of Engineers, Afghanistan Engineer District-South.

8.2.2 ELECTRICIANS

Electricians must be graduates of an approved trade school and must be able to provide upon request a certification of successful course work completion and graduation in addition to a resume of work experience.

8.3 DESIGN CRITERIA

8.3.1 APPLICABLE STANDARDS

Design shall be in the required units as stipulated herein. Conflicts between criteria and/or local standards shall be brought to the attention of the Contracting Officer for resolution. In such instances, all available information shall be furnished to the Contracting Officer for approval. All electrical systems and equipment shall be installed in accordance with the requirements set forth in the documents referenced herein.

8.3.2 ACCEPTANCE TESTING

Contractor shall develop and submit for approval complete acceptance test procedures on all systems provided. As a minimum the testing procedures shall comply with the requirements of the National Fire Protection Association (NFPA) and the International Electrical Testing Association Inc. (NETA).

8.4 MATERIAL

8.4.1 GENERAL

Unless noted otherwise, all material used shall be in compliance with the requirements of UL standards. In the event that UL compliant materials are not available, Contractor may then select applicable British Standards (BS), IEC, CE, CSA, GS, DIN listed material (or equivalent), but the Contractor must prove equivalence and must provide the government with a full copy of the relevant specification(s)/standard(s). Material and equipment installed under this contract shall be for the appropriate application and installed in accordance with manufacturers recommendations.

Equipment enclosure types shall be in compliance with the National Electrical Manufacturer's Association (NEMA) or the International Electro-Technical Committee (IEC) standards.

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a non-corrosive and non-heat sensitive plate, securely attached to the equipment. All equipment delivered and placed in storage, prior to installation, shall be protected from the weather, humidity and temperature variation, dirt and dust, and any other contaminants. All equipment shall be in new condition, undamaged and unused.

8.4.2 STANDARD PRODUCT

All material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

8.4.3 DESIGN CONDITIONS

All equipment shall be rated and designed for the maximum ambient temperature and altitude of the construction site. Equipment that is altitude and temperature sensitive, such as generators, shall be

derated according to the manufacturer's recommendations. Generic derating criteria for altitude and for ambient temperature may be used to approximate the required size of such equipment during the design phase, but a stipulation shall be placed on the construction plans to adjust the size according to the derating criteria specific to the manufacturer's equipment chosen before the equipment is ordered.

8.4.4 RESTRICTIONS

Aluminum conductors shall not be specified or used except as bare steel reinforced (ACSR) overhead conductors in an aerial primary distribution system.

8.5 DESIGN REQUIREMENTS

8.5.1 ELECTRICAL DISTRIBUTION SYSTEM

The Contractor shall provide generator power as described in the paragraph **Generator Power System** as a prime source of power for the facilities.

The Contractor shall design and build a prime power distribution system to distribute power to the site's facilities and other loads as required. The distribution system shall be underground.

Load bank shall be rated at a minimum of 200 kW, with 5, 10, or 20 kW load steps. Unit shall be provided with a control panel and necessary circuit protection. Load bank shall automatically prevent the generator(s) from operating at less than 40% load and keep the generator(s) from "wet-stacking". The underground portion of the distribution system shall be in direct buried schedule 80 ductbanks, except for under roadways and heavy traffic areas, with the ducts not less than 600mm below grade. Manholes and handholes shall be provided at changes of direction of more than 40 degrees and elsewhere as required to limit the pulling tension and sidewall pressure on the cables during installation to acceptable levels as defined by the cable manufacturer. Manholes shall be provided for ductbanks with more than 2 ducts. Handholes shall be provided wherever a manhole is not required by quantity of ducts or by cable manufacturer's installation recommendations. Underground ducts shall be not less than 100mm diameter Schedule 80 PVC for non roadway and light traffic areas and concrete encased schedule 40 for roadways and heavy traffic areas. The Contractor shall provide one additional duct per duct bank beyond the design for future growth.

The Contractor shall design and build a medium voltage primary distribution system with distribution feeders to supply power to distribution transformers. The transformers shall be loop feed, dead front type with load break elbows. Each transformer shall be sized to provide power for the total load of the facility served without being loaded to more than 110% of its rated capacity.

The Contractor shall provide a concrete slab and metal canopy sized to contain the required generators and their associated switchgear and equipment. The Contractor shall provide all required conduit stub ups to connect all equipment (both present and planned) to the switchgear lineup. If the generators supply power at less than the distribution voltage, the Contractor shall provide stepup transformers and the required conduits to connect the generators to their respective transformer and the transformers to the switchgear lineup.

Transformers shall be strategically located close to the loads. Transformers shall be Primary 'Delta' and Secondary 'Wye' connected. Primary side load-break disconnecting means shall be provided with all transformers. Transformers shall come complete from manufacturer. Transformer selection, design, and installation shall be governed by NESC, ETL 1110-3-412, TM 5-684, UFC 4-510-01, UFC 3-550-01, IEEE C57.12.28, ANSI/IEEE C57.12.22, IEEE C57.12.34, and C57.12.80.

Size of transformers, generators, and power feeds shall be governed by UFC 4-510-01, NFPA 99. In case of conflict between transformer design criteria between the above named standards, UFC 4-510-01 shall govern; in cases where UFC 4-510-01 cannot resolve the conflict, it shall be brought to the attention of the Contracting Officer for resolution.

The Contractor shall provide a street lighting distribution system to supply power to the site's street lighting circuits. The street lighting system shall be underground in direct buried schedule 40 PVC not

less than 50mm in diameter and not less than 600mm below grade. The street lighting ducts shall be concrete encased in areas subject to vehicular traffic, such as road crossings and parking areas. Secondary electrical distribution system shall be 380Y/220V, 50 Hertz, 3 phase, 5 wire (4 wire plus circuit protective conductor using 5 wire Terra Neutral – Separate “TN-S”).

Design of the electrical system within facilities shall include, but is not limited to (a) interior secondary power distribution system, (b) lighting and power branch circuit and devices, and (c) fire detection and alarm system. All systems shall be designed for the ultimate demand loads, plus 25% spare capacity.

The Contractor shall provide feeders from the distribution system to each facility. Equipment shall include a distribution panelboard sized to supply the total load of each facility. Feeder lengths shall be kept as short as possible to minimize voltage drop.

All panelboards shall be circuit breaker ‘bolt-on’ type panels. Circuit breakers shall be connected to bus bar(s) within the panelboards. Daisy chain (breaker-to-breaker) connection(s) are not acceptable. Indoor distribution panels shall be surface mounted. All circuit breakers shall be labeled with an identification number corresponding to the panel schedule. A 3-pole circuit breaker shall be a single unit and not made up of 3 single pole circuit breakers connected with a wire or bridge to make a 3-pole breaker. All branch circuit wiring shall be copper. All panels shall be provided with a minimum of 25% spare capacity for future load growth. Power receptacles (outlets) shall be 220 V, 50 hertz, 16 amp type CEE 7-7 three-wire grounded and shall be compatible with the required secondary power. All splicing and terminations of wires shall be performed in junction or device boxes. Proper wire nuts/connectors shall be used for splicing wire. No twist-wire connections with electrical tape wrapped around it shall be acceptable. All electrical installation shall be in accordance with NFPA 70 (National Electric Code), British Standard (BS) Wiring Regulations, International Electrotechnical Commission (IEC) standards, or Deutsches Institut für Normung (DIN) standards. Receptacle locations shall be coordinated with architectural requirements.

Contractor shall design and provide circuits for all mechanical equipment and any other equipment that requires power and make the final connections.

All loads shall be coordinated to provide balanced loading

Voltage Drop for branch circuits should be limited to no more than 3%; voltage drop for branch and feeder circuits combined should be limited to no more than 5%.

All circuit breakers shall use down-stream coordination to ensure the breaker nearest a fault or overload is the first to trip.

8.5.1.1 GENERATOR POWER SYSTEM

The generator power system, whether serving as the prime source or as a backup source of power, shall be configured as an N+1 system with the N representing the number of generators needed to supply the site's total load and the +1 representing the number of additional generators of the same size required as spares. The site's total load is defined as the site's total demand load + 25% spare capacity. The generators may supply power at the utilization voltage of the facilities served or at a higher distribution voltage. If the site requires a higher distribution voltage, step up transformers shall be provided.

Install a generator rated for operating in 50 degree Celsius environment.

The generator power system shall be equipped with synchronizing/paralleling equipment to allow the generators to share the load of the site. When generator power is required at least one (1) generator shall be online at all times. When the site's load reaches 90% of the online generator's capacity, another generator(s) shall start. The generator that synchronizes first shall come online and share the load equally. When the site's load drops below 80% of the online generators' combined capacity, the generator(s) shall drop off line, one at a time, keeping a minimum of one generator operating online.

Whenever a generator stops, it shall go through a cool down cycle prior to shutdown. All relaying shall be automatically reset for automatic restart and stopping of generators as the load increases or decreases. Load sharing by the standby generator(s) shall be adjustable between 50% and 95% of the load on the online generator(s). Sequence of operation shall be time clock controlled. A properly sized main

switchboard shall be provided to distribute the power produced by the generator(s) to the facilities on the site.

For fuel storage requirements, see Mechanical paragraph: Generator Fuel Storage/Distribution.

8.5.2 LIGHTING

Design levels shall be per IES standards as a minimum. For convenience, the following lighting level table is listed. Note: all spaces listed below may not be within the work required within this contract.

Living room/Quarters	35 FC (350 Lux)
Toilets, Showers, Latrines, washrooms	20 FC (200 Lux)
Mechanical/Electrical rooms	30 FC (300 Lux)
Corridors and Stairways	20 FC (200 Lux)
Offices (private)	50 h/5 v FC (500 h/50 v Lux)
Office areas (open)	30 h/5 v FC (300 h/50 v Lux)
Kitchens (commercial)	70 h/3 v FC (700 h/30 v Lux)
Dining Areas	20 h/3 v FC (200 h/30 h Lux)
Auditoriums (social)	5 h/3 v FC (50 h/30 v Lux)
Conference	30 h/5 v FC (300 h/50 v Lux)
Armories	30 h/3 v FC (100 h/30 v Lux)
Reading (at desk-serious)	50 h/10 v FC (500 h/100v Lux)
Patient Rooms (general)	Per UFC 4-510-01
Patient Rooms (critical)	Per UFC 4-510-01
Egress path (incl. exterior)	10 Lux
Areas adjacent to egress path	0.5 Lux
Road Intersections	10 Lux
Perimeter Roads	0.5 Lux
Areas Requiring Lighting Per Section 01010	0.5 Lux

FC = FootCandle

h = horizontal component

v = vertical component

8.5.2.1 SEARCHLIGHTS

Searchlights shall be provided in guard towers and shall be equivalent to the following:

- a. Prison grade
- b. Nickel reflectors (bullet resistant)
- c. 1,000 watts
- d. Manual operation from below with one hand
- e. Xenon lamp
- f. Weatherproof design

8.5.3 INTERIOR AND EXTERIOR LIGHTING

Indoor lighting for all areas shall consist of fluorescent surface mounted light fixtures. Exterior lighting shall be HID (metal halide or high pressure sodium). Moisture resistant/waterproof fluorescent light fixtures shall be provided in high humidity and wet areas such as latrines, showers and outside. Battery powered 'emergency' and 'exit' lights shall be provided within each building, as applicable, for safe egress during a power outage. All light fixtures shall be factory finished, complete and operational, to include but not be limited to, lens, globe, lamp, ballast etc. Industrial type fluorescent light fixtures shall not be used. Every room shall be provided with a minimum of one light switch. Light fixtures shall be mounted approximately 2.5-meters above finished floor (AFF) minimum. Fixtures may be pendant or ceiling mounted, depending on the ceiling type and height.

8.5.4 LIGHT FIXTURES

Lighting fixtures shall be a standard manufacturer's product. Fluorescent surface mounted light fixtures shall be power factor corrected and equipped with standard electronic ballast(s), except in medical facilities where magnetic ballast(s) are required. Ballasts shall be rapid start type. All light fixtures shall properly operate using standard lamps available locally. Fixtures shall be fully factory wired and designed for appropriate application i.e. appropriate for that location where installed.

8.5.5 EMERGENCY "EXIT" LIGHT FIXTURES

Emergency "EXIT" light fixture shall be provided in accordance with NFPA requirements. Fixtures shall be single or double sided as required by the location and for wall/ceiling mounting. Unit shall illuminate continuously and be provided with self-contained nickel cadmium battery pack, to operate on floated-battery or trickle charge circuit. Fixture shall operate satisfactorily for 90 minutes during a power outage. Unit shall have test/re-set button and failure indication lamp. Primary operating voltage shall be 220 volts. Lettering "EXIT" shall be color red and not less than 150 mm in height and on matte white background. Illuminations shall be with LEDs.

8.5.6 EMERGENCY LIGHTING

Battery powered emergency lights shall be provided within each building per NFPA for safe egress during power outage. Fixtures shall be provided with self-contained nickel cadmium battery pack to operate on stand-by circuit for 90-minute minimum. Unit shall have test/re-set button and failure indication lamp. Normal operating voltage shall be 220 volts. Emergency lighting fixtures shall be connected to the normal lighting system.

8.5.7 LIGHT SWITCHES

Light switch shall be single pole. Minimum of one light switch shall be provided in every room. Lighting in rooms with multiple means of egress may be controlled from multiple switches.

8.5.8 RECEPTACLES

General-purpose receptacles shall be as required herein.

Areas with computer work-stations or similar equipment will have additional receptacles. Sinks may have a receptacle above. Receptacles in wet/damp areas or within 1 meter of sinks, lavatories, or wash-down areas shall be ground fault circuit interrupter (GFCI) type or residual current disconnect (RCD) type, with the trip setting of 6 milliamperes or less. Total number of receptacles shall be limited to six (6) per 20-ampere circuit breaker.

8.5.9 CONDUCTORS

All cable and wire conductors shall be copper. Refer to BS 7671 for conductor jacket or insulation color coded requirements. The use of 75 or 90 degree C (minimum) terminals and insulated conductors is required. Use of higher degree C rated conductors on circuits with protective device terminals rated at a

lower degree C is allowed but must be derated to the rating of the device terminals.

8.5.10 GROUNDING AND BONDING

Refer to BS 7671 for grounding and bonding requirements. All exposed non-current carrying metallic parts of electrical equipment in the electrical system shall be bonded. Insulated equipment grounding conductor (separate from the electrical system neutral conductor) shall be installed in all feeder and branch circuit raceways. Equipment grounding conductor shall be green-colored, unless the local authority requires a different color-coded conductor. If required, ground rods shall be 20 millimeters in diameter and 3 meters long made of copper-clad steel.

8.5.11 ENCLOSURES

Enclosures for exterior and interior applications shall be NEMA Type 3S (IEC Classification IP54) and NEMA Type 1 (IEC Classification IP10) respectively.

8.5.12 FIRE DETECTION & ALARM SYSTEM

The Contractor shall install hardwired smoke detectors to provide local alarm only.

8.5.13 CONDUIT RACEWAY SYSTEM

Metal conduit (EMT) system shall be complete, to include but not limited to, necessary junction and pull boxes for all surface mounted conduit systems. PVC conduit, junction and pull boxes are allowed for raceways not subject to severe damage. All empty conduits shall be furnished with pull wire or cord or rope (depending on the size of conduit and length of run). Refer to BS 7671 for system design and installation requirements.

8.5.14 CABLE TRAY RACEWAY SYSTEM

Cable trays shall be ladder type and provided with, but not limited to, splices, end plates, dropouts and miscellaneous hardware. System shall be complete with manufacturer's minimum standard radius and shall be free of burrs and sharp edges. Refer to BS 7671 for nominal width of cable tray requirements.

8.5.15 IDENTIFICATION NAMEPLATES

Major electrical equipment, such as transformers, panelboards, and load centers, etc. shall be provided with permanently installed engraved identification nameplates.

8.5.16 SCHEDULES

All panel boards and load centers shall be provided with a directory. Directory shall be typed written in English, Dari, and Pashto. The directory shall also indicate the source where the panelboard/loadcenter is fed from.

8.5.17 SINGLE LINE DIAGRAM

Complete single line diagrams shall be provided for all systems installed. All major items in each system shall be identified and labeled for respective ratings. Single line diagrams for each system, installed in a clear plastic enclosure, shall be provided. Most current version of design, based on current design review, shall be kept on project site at all times for reference, and updated with redline edits to show any and all variations from the drawings.

8.6 OPERATIONS AND MAINTENANCE (O&M) FOR ELECTRICAL

The O&M manuals must be provided prior to any training activities. Manuals shall be "tri-lingual" in Dari, Pashto and English.

All control panels shall have tri-lingual name plates in Dari, Pashto and English.

The Contractor shall provide an outline of the training lesson plan (to be approved by the Government) prior to conducting training. CD recordings of training on video shall also be provided, after training is conducted.

9.0 COMMUNICATIONS SYSTEM

9.1 APPLICABLE SPECIFICATIONS

The Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by designation only.

United States Department of Agriculture, Rural Utilities Service

RUS Bulletin 1751F-643 (2002) Underground Plant Design

RUS Bulletin 1751F-644 (2002) Underground Plant Construction

RUS Bulletin 1753F-151 (2001) Construction of Underground Plant, Parts II & III

RUS Bulletin 1753F-201 (1997) Acceptance Test and Measurements Of Telecommunications Plant

RUS Bulletin 1753F-208 (1993) Specifications for Filled Telephone Cables with Expanded Insulation (PE-89)

RUS Bulletin 1753F-401 (1995) Standards for Splicing Copper And Fiber Optic Cable (PC-2)

RUS Bulletin 1753F-601 (1994) Specifications for Filled Fiber Optic Cables (PE-90)

RUS Bulletin 1753E-001 (1996) RUS General Specification for Digital, Stored Program Controlled, Central Office Equipment, RUS Form 522.

RUS Publication IP 344-2 (2006) List of Materials Acceptable For Use on Telecommunications Systems of RUS Borrowers.

RUS Bulletin 345-65 (1978) Shield Bonding Connectors (PE-33)

RUS Bulletin 345-83 (1982) REA Specification for Gas Tube Surge Arrestors (PE-80)

RUS Bulletin 1753E-001 (1996) RUS General Specification for Digital Stored Program Controlled Central Office Equipment, (Form 522)

American National Standards Institute/Telecommunications Industry Association/Electronics Industry Association

ANSI TIA/EIA 606-A (2002) Administration Standard for The Telecommunications Infrastructure

ANSI TIA/EIA 607-A (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

ANSI TIA/EIA 607-A (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

ANSI TIA/EIA 568 (2001) Commercial Building Telecommunications Cabling Standard

ANSI TIA/EIA 569-B (2004) Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI TIA/EIA 758-A (2004) Customer-owned Outside Plant Telecommunications Infrastructure Standard

9.2 COMMUNICATION SYSTEMS DESIGN

The communications system for this project is to be designed, supplied and constructed by the Contractor. The design and construction of the systems shall be in accordance with the references and the requirements contained herein.

9.3 EXTERIOR COMMUNICATION SYSTEM

The Contractor shall coordinate the communication system with the power distribution system to distribute communications to the site's facilities as required. The distribution system shall be underground. Manholes and hand-holes shall be constructed in accordance with the contract drawings. The maximum distance between manholes and/or hand-holes shall be 140 m. The ducts shall be direct buried with a minimum of 1000 mm of properly tamped dirt/backfill on the top. Hand-holes shall be installed in laterals in between manholes and buildings and only where the distance between the main duct system and the building is 100 meters or more. The maximum number of ducts in a hand-hole wall shall be two, with one having four (4) inner ducts installed unless there are two buildings close by and can be fed from one hand-hole. In this case, four (two with inner ducts) conduits can be installed in the walls.

9.4 EXTERIOR CONDUIT

The underground conduit for the manhole and duct system shall be direct buried (1 meter below surface), 100 mm DB type PVC or schedule 40, PVC. Inner ducts shall be four (4) 25 mm PVC or PE inner ducts field installed in the outer-duct. The inner ducts shall be installed in the duct face and secured with properly sized duct plugs which expand to seal the duct. The ducts will be concrete encased where a road or taxi way is crossed. The ducts (inner and outer) shall be listed on the RUS list of materials acceptable for use on RUS projects. Cable racking diagrams (manhole/hand-hole butterflies) shall be provided for the manholes and hand-holes. The minimum duct configuration in the main duct system shall be a six way duct, being three conduits wide by two conduits deep (3 X 2) with two of the conduits having inner-ducts installed. Laterals off of the main duct system manhole to manhole shall be a minimum of a 4 way (2x2) with one duct having inner ducts. The duct system from the manhole/hand hole to a building with cable installed shall be a 1x2, 100 mm PVC duct bank with one duct having inner ducts. The duct system from a manhole/hand-hole to a building with allocations only shall be two (2), 100 mm DB type PVC conduits stubbed out 3 meters from the manhole/hand hole. All conduits shall be terminated in ABS plastic terminators cast into the walls of the concrete structures. In manholes, all conduit windows shall be recessed.

-END OF SECTION-